

# Connected Vehicle Pilot Deployment Program Phase 1

## Deployment Readiness Summary – Tampa (THEA)

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<b>16. Abstract</b> The Tampa Hillsborough Expressway Authority (THEA) Connected Vehicle (CV) Pilot Deployment Program intends to develop a suite of applications that utilize vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication technology to reduce traffic congestion, improve safety, and decrease emissions. These CV applications support a flexible range of services, including advisories, roadside alerts, transit mobility enhancements, and pedestrian safety. The pilot is conducted in three phases. Phase 1 includes the planning for the CV pilot including the concept of operations development. Phase 2 is the design, development, and testing phase. Phase 3 includes a real-world demonstration of the applications developed as part of this pilot.  This document represents the Deployment Readiness Summary.  The Deployment Readiness Summary intends to demonstrate the pilot site has satisfied all elements required for the deployment and has responded to an agreement that funds the design, build, test and operation of the proposed pilot deployment.					
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<b>ACRONYM</b>	<b>DEFINITION</b>
<b>BRT</b>	Bus Rapid Transit
<b>BSM</b>	Basic Safety Message
<b>CAMP</b>	Crash Avoidance Metrics Partnership
<b>CBD</b>	Central Business District
<b>ConOps</b>	Concept of Operations
<b>CSW</b>	Curve Speed Warning
<b>CV</b>	Connected Vehicle
<b>CVRIA</b>	Connected Vehicle Reference Implementation Architecture
<b>DSRC</b>	Dedicated Short Range Communications
<b>EEBL</b>	Emergency Electronic Brake Light
<b>FCW</b>	Forward Collision Warning
<b>HART</b>	Hillsborough Area Regional Transit
<b>HCC</b>	Hillsborough County Community College
<b>HMI</b>	Human Machine Interface
<b>IMA</b>	Intersection Movement Assist
<b>I-SIG</b>	Intelligent Signal Systems
<b>MAFB</b>	MacDill Air Force Base
<b>MOU</b>	Memorandum of Understanding
<b>O&amp;M</b>	Operations and Maintenance
<b>OBE</b>	On-Board Equipment
<b>OBU</b>	On-Board Unit
<b>OSADP</b>	Open Source Application Development Portal
<b>PDETM</b>	Probe Data Enabled Traffic Monitoring
<b>PED-SIG</b>	Mobile Accessible Pedestrian Signals System
<b>PED-X</b>	Pedestrian in a Signalized Crosswalk
<b>PID</b>	Personal Information Devices
<b>PII</b>	Personally Identifiable Information
<b>PSM</b>	Personal Safety Message
<b>RDE</b>	Research Data Exchange
<b>REL</b>	Reversible Express Lanes
<b>RLVW</b>	Red Light Violation Warning
<b>RSE</b>	Roadside Equipment
<b>RSU</b>	Road Side Unit
<b>SCMS</b>	Security Credential Management System
<b>TERL</b>	Transportation Engineering Research Laboratory
<b>THEA</b>	Tampa Hillsborough Expressway Authority
<b>TMC</b>	Transportation Management Center
<b>TSP</b>	Transit Signal Priority
<b>USDOT</b>	United States Department of Transportation
<b>V2I</b>	Vehicle-To-Infrastructure
<b>V2V</b>	Vehicle-To-Vehicle

<b>V2X</b>	Vehicle-To-Everything
<b>VTRFTV</b>	Vehicle Turning Right in Front of a Transit Vehicle

# 1 Introduction

## 1.1 Deployment Overview

The Tampa Hillsborough Expressway Authority (THEA) Connected Vehicle (CV) Pilot is nearing Phase 1 completion and preparing to perform Phase 2 and Phase 3 to meet the requirements of the United States Department of Transportation's (USDOT) Broad Agency Announcement (BAA) to advance and enable safe, interoperable, networked wireless communications among vehicles, the infrastructure, and travelers' personal information devices and to make surface transportation safer, smarter, and greener. The Pilot will demonstrate the kinds of improvements that can be made in an urban environment, within Tampa's Central Business District (CBD). THEA is deploying site-tailored collections of applications to address specific local needs while laying a foundation for additional local/regional deployment, and providing transferable lessons learned for other prospective deployers across the nation.

The Pilot in downtown Tampa is creating a connected urban environment to measure the effect and impact of CVs in Tampa's vibrant downtown. To the vision of a connected downtown, the proposed Pilot will deploy several CV applications in Tampa's CBD; which is one square mile in size. This environment has a rich variety of traffic, mobility and safety situations which lend themselves to Vehicle to Vehicle (V2V), Vehicle to Infrastructure (V2I), and Vehicle to Everything (V2X) solutions. The deployment area is within a busy downtown and offers a tolled expressway with street-level interface, bus and streetcar service, high pedestrian densities, special event trip generators and high dynamic traffic demand over the course of a typical day.

These diverse environments in one concentrated deployment area collectively encompass many traffic situations that allow for deployment and performance testing of CV applications.

The Pilot comprises THEA/City of Tampa (CoT) Combined Traffic Management Center (TMC) Operations, Hillsborough Area Regional Transit (HART) Bus Operations, CoT signal Operations and Maintenance (O&M), CV-Pilot System Development, CV-Pilot Design, Deployment and O&M, Key Agency Partners, Stakeholders and System Users, and Sustainability Models/Partners.

The goals and objectives for the THEA CV Pilot are:

### **Goal 1: Develop and Deploy CV Infrastructure to Support the Applications Identified During Phase 1**

- Objective 1: Deploy Dedicated Short Range Communications (DSRC) technologies to support V2V, V2I and V2X applications
- Objective 2: Upgrade TMC software to ensure compatibility with CV Applications
- Objective 3: Recruit a fleet of transit and private vehicle owners and individuals carrying V2X-enabled mobile devices to participate in the CV Pilot by installing and using CV technology offered in the pilot.

## **Goal 2: Improve Mobility in the CBD**

- Objective 1: Replace existing traffic controllers and control systems at key intersections with Intelligent-Signal Systems (I-SIG) CV technology to improve traffic progression at identified problem areas.
- Objective 2: Provide Transit Signal Priority (TSP) applications to help HART buses stay on a predictable schedule.
- Objective 3: Provide Bus Rapid Transit (BRT) applications to improve overall operation and encourage increased ridership

## **Goal 3: Reduce the Number of Safety Incidents within the Pilot Area**

- Objective 1: Provide detection of pedestrians and warnings to drivers of potential pedestrian conflicts.
- Objective 2: Provide detection of potential vehicle conflicts and warnings to pedestrians.
- Objective 3: Provide early detection of wrong-way drivers and issue warnings to wrong-way drivers and upstream motorists
- Objective 4: Give drivers warnings of the Reversible Express Lane (REL) exit curve and stopped vehicles ahead
- Objective 5: Provide detection and warning of potential conflicts between streetcar vehicles and autos, pedestrians/bicycles

## **Goal 4: Reduce Environmental Impacts within the Pilot Area**

- Objective 1: Provide CV Mobility and Safety applications to improve overall mobility and reduce stops and idle time within the CBD, thus reducing emissions
- Objective 2: Provide TSP applications to reduce idle time of HART buses
- Objective 3: Provide BRT applications to improve overall operation and encourage increased ridership

## **Goal 5: Improve Agency Efficiency**

- Objective 1: Improve traffic data collection capability, reducing the costs of collecting data
- Objective 2: Reduce the number of incidents and police and rescue responses to incidents
- Objective 3: Reduce crashes and time agencies take to gather data
- Objective 4: Improve technology for crash statistics gathering
- Objective 5: Improve scheduling and dispatching of HART vehicles with improved trip times and vehicle information
- Objective 6: Reduce overhead of THEA responding to wrong-way entries and crashes on REL exit ramp

## **Goal 6: Develop Business Environment for Sustainability**

- Objective 1: Work with the Crash Avoidance Metrics Partnership (CAMP), OEM's, and third party developers to develop business cases for advancing CV-ready vehicles
- Objective 2: Work with industry sectors that will benefit from CV implementation, e.g.: insurance carriers, fleet managers, safety organizations, etc., to provide education on the benefits and seek support for advancement of the system
- Objective 3: Work with Chambers of Commerce and other business organizations to educate members on the return on investment from increased mobility.

- Objective 4: Work with state and local Government to encourage positive legislation and funding in support of CV technology.

## 1.2 Purpose of the Report

In order to initiate Phase 2 Design and Deployment of the Pilot and Phase 3 Operate and Maintain the Pilot, the Pilot must demonstrate it has completed Phase 1 Planning for the Pilot. The Deployment Readiness Summary (DRS) documents all deliverables have been finalized with all COR comments mutually agreed upon incorporated into the planning documents. Through the course of developing the planning documents, how the Pilot Goals and Objectives were met was described.

The DRS describes the approach of having an infrastructure integrator, in-vehicle integrator, a personal information device (PID) integrator, and an oversight of the complete system integration. Planning for Phase 3 Operation and Maintenance are discussed including partners and roles and responsibilities.

## 1.3 Organization of the Report

This section provides information on how the sections are organized and a brief description of each section.

Section 2 Deliverables provides a discussion of the Phase 1 deliverables; including submittal status, submittal draft date, submittal final date, submittal revised date, submittal final date, submittal Section 508 date, and published date.

Section 3 Required Elements describes the extent to which the Pilot concept addresses each required element of the Pilot concept elements that relate to the requirements.

Section 4 Teaming Framework describes the relationship between THEA and the stakeholders and partners. The section includes Memorandum of Understanding (MOU) or equivalent and other agreements such as governance and financial agreements if necessary.

Section 5 Deployment Scope discusses pilot scope including geographic boundaries, number of vehicles, devices, and roadside equipment.

Section 6 Risk Assessment discusses the key technical risks and key institutional risks. These risks should include application maturity, software development, equipment procurement, and Phase 3 roles and responsibilities.

# 2 Phase 1 Deliverables

This chapter provides a punch-list of Phase 1 deliverable provision/status. All Phase 1 deliverables and their status are listed. The status options are listed below:

- Not submitted.
- Submitted draft version (date) – The draft version is submitted to USDOT. THEA is waiting for COR review or is revising the draft.
- Submitted revised version (date) – The revised version is submitted to USDOT with edits in response to comments. THEA is waiting for COR review or is finalizing the deliverable.
- Final deliverable approved (date) – The final version of the deliverable is approved by USDOT. THEA is working on the 508 format of the final deliverable.
- Submitted 508 version (date) – The 508 version of the final deliverable is submitted. THEA is waiting for the 508 review by USDOT publication staff.
- Published (date) – The final deliverable has been published online.

For deliverables not in the “Submitted 508 version” or “Published” status, THEA is currently in various stages of obtaining final deliverable approval. All deliverables, except for this document, have been submitted to USDOT for review. THEA expects all deliverables to be approved and in the publication process by the conclusion of Phase 1.

Table 2.1 presents a list of BAA contract deliverables with their current status as of the date of this report and the date that final document was, or is projected to be, submitted in 508 format for publication.

**Table 2.1 Project Deliverables**

Task 1 Deliverables	
Kickoff Briefing	Held 9/30/15
Final Program Management Plan	Approved 10/29/15
Monthly Progress Report (September)	Submitted 10/8/15
Monthly Progress Report (October)	Submitted 11/8/15
Monthly Progress Report (November)	Submitted 12/8/15
Monthly Progress Report (December)	Submitted 1/8/16
Monthly Progress Report (January)	Submitted 2/8/16
Monthly Progress Report (February)	Submitted 3/8/16
Monthly Progress Report (March)	Submitted 4/8/16
Monthly Progress Report (April)	Submitted 5/8/16
Monthly Progress Report (May)	Submitted 6/8/16
Monthly Progress Report (June)	Submitted 8/8/16
Monthly Progress Report (July)	Submitted 8/8/16
Monthly Progress Report (August)	Submitted 9/8/16

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2 Phase 1 Deliverables

Monthly Progress Report (September)	Expected by 10/8/16
<b>Task 2 Deliverables</b>	
Final Stakeholder Concept of Operations (ConOps) Review Panel Roster	Approved 11/30/15
Final Needs Summary	Approved 12/14/15
ConOps Walkthrough Briefing Deck	Submitted 1/20/16
Final ConOps	Published 2/18/16
Final ConOps Comment Resolution Report	Published 2/18/16
Public ConOps Webinar	Held 2/8/16
<b>Task 3 Deliverables</b>	
Final Security Management Operating Concept	Published 4/7/16
<b>Task 4 Deliverables</b>	
Final Safety Management Plan	Published 4/1/16
<b>Task 5 Deliverables</b>	
Final Performance Measurement Plan	Submitted 508 Version 7/25/16
Performance Measurement Webinar	Held 6/7/16
<b>Task 6 Deliverables</b>	
Final Stakeholder SyRS Review Panel Roster	Approved 3/25/16
SyRS Walkthrough Workbook	Approved 4/21/16
Final SyRS	Submitted Revised 9/8/16
Final SyRS Resolution Report	Submitted Revised 9/8/16
<b>Task 7 Submittals</b>	
Application Deployment Plan	Submitted Revised 9/8/16
<b>Task 8 Submittals</b>	
Human Use Approval Summary	Published 7/25/16
<b>Task 9 Submittals</b>	
Participant Training & Stakeholder Education Plan	Submitted 508 version 8/15/16
<b>Task 10 Deliverables</b>	
Partnership Status Summary	Submitted 508 version 8/8/16
<b>Task 11 Deliverables</b>	
Deployment Outreach Plan	Submitted 508 version 7/5/16
<b>Task 12 Deliverables</b>	
Comprehensive Deployment Plan	Submitted 508 version 9/2/16
Deployment Plan Webinar	Held 8/19/16
<b>Task 13 Deliverables</b>	
Deployment Readiness Summary	Submitted Draft 8/26/16
Deployment Readiness Briefing	Scheduled for 9/22/16

# 3 Required Elements

The subchapters in this Chapter discuss how the pilot meets the required elements of the project. This discussion covers the pilot concept to the extent it has been developed in Phase 1.

## 3.1 Element A: At Least One USDOT-Developed Application

One of the goals of the THEA Pilot was to reuse as many available open source applications as possible to demonstrate the effectiveness of the applications and measure the performance using those applications. THEA reviewed the Open Source Application Development Portal (OSADP) and other open source USDOT funded applications. As of today, THEA plans to utilize three of the eleven applications from open source. The applications are:

1. Intelligent Traffic Signal System (I-SIG)
2. Transit Signal Priority (TSP)
3. Mobile Accessible Pedestrian Signal (PED-SIG)

THEA has downloaded and reviewed these applications' source code in order to develop its estimates for Phase 2 development.

For the remaining applications, THEA will work with the CV device manufacturers, the CAMP and other interested parties to finalize the remaining applications.

## 3.2 Element B: Two or More Applications with Clear Synergy

THEA's approach to the project was to develop a set of Use Cases (6 in total) with each Use Case implementing multiple applications. Below are the Use Cases and the applications associated with each Use Case. It is important to note that applications appear in more than one Use Case and several of the Use Cases overlap in the same deployment area.

1. **Use Case 1 – Morning Peak Hour Queues**
  - a. Curve Speed Warning (CSW)
  - b. Forward Collision Warning (FCW)
  - c. Emergency Electronic Brake Light (EEBL)
  - d. Intelligent Traffic Signal System (I-SIG)

For Use Case 1, THEA is using I-SIG to determine the queue length that builds up on the REL exit curve. As the queue builds, the safe stopping distance in the curve reduces, thus requiring a reduced speed to stop safely. The queue length will be used to dynamically modify the recommended curve speed that is being sent by the CSW application. FCW warns the driver of an impending rear-end collision with another vehicle ahead in traffic in the same lane and direction of travel in order to take remedial action. EEBL enables a vehicle to broadcast a self-generated emergency brake

event to surrounding vehicles which is especially effective when sight conditions are compromised by weather, vehicles or infrastructure.

**2. Use Case 2 – Wrong Way Entries**

- a. I-SIG
- b. Red Light Violation Warning (RLVW)
- c. (Intersection Movement Assist (IMA)

In Use Case 2, the three applications work in concert to warn a potential wrong-way driver that they are entering the REL in the wrong direction. RLVW is used to establish a virtual red phase on the REL exit lanes. When IMA or I-SIG detects a vehicle “running the red light”, the driver will be warned they are about to enter the REL going the wrong way. If the driver continues through the intersection, RLVW will alert the driver they are going the wrong way and a warning is sent to approaching vehicles and to law enforcement.

**3. Use Case 3 – Pedestrian Safety**

- a. I-SIG
- b. Pedestrian Mobility (PED-X)
- c. Pedestrian in Signalized Crosswalk Warning (PED-SIG)

For Use Case 3, the three applications work together to provide warnings to drivers and pedestrians of potential collisions. I-SIG will receive data from vehicles, PID equipped pedestrians and local pedestrian detection devices and use the data to manage the crosswalk area. PED-X and PED-SIG work together to receive data from the I-SIG to warn pedestrians of potential vehicle conflicts. On-Board Unit (OBU) equipped vehicles receive data from I-SIG which is used by PED-X and PED-SIG to determine potential pedestrian conflicts. In order for pedestrians and vehicles to communicate with one another, the PIDs will transmit Personal Safety Messages (PSMs). RSUs who receive PSMs will convert those messages into BSMs and viceversa.

**4. Use Case 4 – Bus Rapid Transit Signal Priority Optimization, Trip Times and Safety**

- a. I-SIG
- b. IMA
- c. Transit Signal Priority (TSP)

I-SIG is implemented to provide overall management of the intersection in which TSP is implemented to manage signal priority for buses. IMA is used to assist buses when turning to warn of potential conflicts. Mobility improvements include clearing the intersection of vehicles which are blocking the bus’s exit of the bus stop and return to normal traffic pattern.

**5. Use Case 5 – TECO Line Streetcar Conflicts**

- a. I-SIG
- b. PED-SIG
- c. PED-X
- d. Vehicle Turning Right in Front of Transit Vehicle (VTRFTV)

I-SIG, PED-SIG, and PED-X work together in a similar fashion as in Use Case 3. VTRFTV warns the streetcar operator of a vehicle potentially turning right in front of the streetcar.

**6. Use Case 6 – Enhanced Signal Coordination and Traffic Progression**

- a. I-SIG
- b. IMA
- c. Probe Data Enabled Traffic Monitoring (PDETM)

I-SIG will be implemented at intersections along Meridian Avenue and Kennedy Boulevard to monitor queue lengths at each intersection and modify the signal timing to move queues through the intersection by extending or providing a green light. IMA will assist drivers turning at the intersections and the PDETM captures Basic Safety Messages (BSMs) used to calculate travel times.

### 3.3 Element C: Appropriate Role for DSRC Communications

The Pilot deployment will deploy several vehicle to vehicle (V2V) applications using DSRC as the communication medium. DSRC is used to communicate from vehicles to infrastructure (Roadside Units [RSUs]) in some cases as well.

- Use Case 1 - V2V is used for FCW and EEBL communication and V2I is used for CSW communication.
- Use Case 2 – V2I is used for RLWW and I-SIG communication and V2V is used for IMA communication.
- Use Case 3 – V2I is used to translate V2X pedestrian locations and movements into DSRC messages for crash avoidance.
- Use Case 4 – V2I is used for I-SIG and TSP to communication and V2V is used for IMA communication.
- Use Case 5 V2I is used for I-SIG to vehicles communication and V2V is used for VTRFTV communication.
- Use Case 6 V2I is used for I-SIG and PDETM communications and V2V is used for IMA communications.

### 3.4 Element D: Utilizing the SCMS

The Pilot deployment plans to implement security using the Security Credentialing Management System (SCMS) provided by USDOT for its applications and hardware. It is anticipated the SCMS will provide trusted communications between devices and protect data from unauthorized access. Devices initialized with trusted credentials will be able to determine if other devices are trustworthy and encrypt the data communication between devices. Security will be performed using keys, certificates and a certificate revocation list.

### 3.5 Element E: Sharing Data and Open Source Code

As stated in 3.1 Element A: At Least One USDOT-Developed Application, one of THEA's goals is to reuse as much open source code as possible for the Pilot. The open source applications are listed in sub chapter 3.1 above. Modifications to the open source code or the newly developed application code/interface will be shared back to the OSADP or other source.

The Pilot will share the CV related data collected during the Phase 3. As part of its performance measurement activities, data will be collected and stored on the Master Server. The data will be cleansed of any potential Personal Identifiable Information (PII). The resulting clean data will be shared with the Research Data Exchange (RDE) and the USDOT evaluator.

## 3.6 Element F: Interfacing with National SCMS

As stated in subchapter 3.4 Element D: Utilizing the SCMS, the Pilot will utilize the USDOT provided SCMS. THEA anticipates having to install and integrate an SCMS application which will be provided by USDOT on its RSUs and OBUs. The devices planned for deployment will have to be bootstrapped such that they can perform security functions. Applications and messages will be signed using certificates. Each device shall have an initial set of certificates onboard. When additional certificates are needed, they may be received through communications from the SCMS to the RSU. OBU certificates may be received from the SCMS to the RSU to the OBU.

The Pilot is also working with Sirius XM to provide satellite communication to certain Sirius XM equipped vehicles which will broadcast certificates via satellite to the equipped vehicles. Once the certificates are received by the satellite receiver, they will be sent to Sirius XM's OBUs which communicate using DSRC.

## 3.7 Element G: Utilizing CVRIA/SET-IT Tools

THEA is committed to using the Connected Vehicle Reference Implementation Architecture (CVRIA) and SET-IT to design its architecture during the later portion of High Level Design and Detailed Design. THEA will build upon the work performed during the User Needs and Concept of Operation development. Because of the complex system planned by THEA, we anticipate that the CVRIA/SET-IT will be valuable in demonstrating how multiple applications will interact at a single location and how all the Use Cases are integrated together.

## 3.8 Element H: Single Lead Organizational Entity

From the beginning, THEA has established itself as the Lead Organizational Entity. THEA with its partners led the development of the selected Pilot proposal. During Phase 1, THEA was the prime contractor leading the planning phase. THEA utilized several subcontractors all of which contracted directly with THEA. THEA utilized its existing relationship with the City of Tampa and the Hillsborough Area Regional Transit (HART) to solidify their partnership and as stakeholders in the Pilot. THEA has continued to its Pilot leadership by leading the response to the Notice of Funding Opportunity for Phase 2 and Phase 3.

THEA Leadership, Joe Waggoner, CEO and Bob Frey Planning have committed a long term investment in CV by placing CV in its thirty year workplan.

# 4 Teaming Framework

This chapter describes the teaming framework in place with signed agreements, including:

- Governance agreements associated with coordinated systems management; and
- Financial agreements signed among all parties engaged in remunerative transfers

## 4.1 Governance Agreements

This section provides a brief summary of existing or planned governance documents relied upon in the planning and execution of the Tampa – THEA CV Pilot. Existing documents are attached hereto as appendices as indicated in the subsections below.

### 4.1.1 Agreement 1 – THEA/City of Tampa (CoT) Inter Local Agreement (ILA)

THEA and the City of Tampa have an existing ILA which is attached hereto as Appendix A. This agreement contains provisions for the shared operations and maintenance costs as well as the framework for additional cooperative efforts. This agreement remains in effect throughout the period of performance of the CV Pilot. A joint review by THEA and CoT was conducted at the outset of the CV Pilot and found to be inclusive of elements needed to support the project without modification. During phases 2/3, the agreement will be the subject of additional reviews to ensure that it continues to adequately cover the CV Pilot needs as it matures.

### 4.1.2 Additional Agreements Under Consideration

Additional ILAs may be required during maturation of Phase 2 and are currently under review. The possible agreements being considered pertain to FDOT District 7 which covers Hillsborough, Pinellas, Hernando and Citrus Counties and HART. An update will be provided in the final Deployment Readiness Report.

## 4.2 Financial Agreements

THEA has negotiated both fixed fee and limiting amount agreements with its sub-consultants. These agreements have not been executed and are considered preliminary until USDOT execution of Phase 2 Cooperative Agreement with THEA. These agreements will be submitted as executed in the Final Deployment Readiness Briefing document. For this draft version, letters of commitment are provided. These letters are attached hereto as Appendix B Sub-consultant Commitment Letters

# 5 Deployment Scope

The Pilot is based on traffic studies within the pilot area that identified six use cases; issues that can potentially be mitigated through the use of CV technology. These issues were chosen based on availability of historic data demonstrating current untreated scenarios, their impact to the community, and the ability to measure the performance of the applied technology versus the current, untreated conditions.

The use cases selected for this Pilot are identified below along with their locations.

- Traffic on the **Selmon Expressway REL approaching E. Twiggs Street** queues during the morning rush hour due to poor signal progression of right turns onto Twiggs immediately followed by a second right turn onto Nebraska Avenue. The queue backs up onto the Selmon Expressway REL exit and into the curve where rear end crashes and other incidents are occurring.
- The **Entrance/Exit point of the REL at Meridian Avenue and Twiggs Street** is a potential site for wrong-way entries. Drivers can enter the REL going the wrong-way by turning right onto the REL, left onto the REL, or going straight onto the REL by veering slightly left. By far, the most troublesome of the three is people turning left onto the REL.
- **Twiggs Street at the Hillsborough County Courthouse** has a mid-block pedestrian crossing combined with no protected left turn into the parking garage for the courthouse. This creates pedestrian safety issues as people traverse Twiggs Street. Pedestrians are also crossing at unmarked locations, further complicating the pedestrian safety concern. Normally, there is commuter traffic from the REL. On Mondays and Tuesdays, the traffic increases because 400 to 600 potential jurors arrive at the Courthouse for jury duty. The increases not only the number of vehicles, but the number of pedestrians as well.
- **HART operates express, local and Bus Rapid Transit (BRT) routes** along and across the downtown city streets to the Marion Street Transit Station. Kennedy Boulevard, which intersects with Marion, is one of the bus routes suffering from poor transit travel time and travel time reliability due to poor signal progression from heavy pedestrian and passenger vehicle volumes and passenger vehicles blocking access to bus stops. Buses along this route, as well as along Marion Street, need priority in order to stay on schedule.
- **The Amalie Arena/Channelside Drive Area** is a tourist destination and event area. Channelside Drive has many types of safety and mobility challenges due to morning and afternoon peak travel, special events, the streetcar and stations. Depending on the time and day, at least two of the issues identified above have a negative impact on overall travel safety and mobility in the area. One critical potential for conflicts is the TECO Line that runs through this area. In many cases, the streetcar runs parallel to vehicle lanes with a common approach to traffic control signals. The signal will be red for all vehicle phases during the streetcar's crossing. However, right turn on red is typically a legal move, which may invite a motorist, unaware of the streetcar's presence, to turn right into its path. Similar scenarios occur during periods of significant pedestrian traffic in this area.

## 5. Deployment Scope

- The **area of downtown Tampa from the Selmon Express Lanes along Twiggs Street to Marion Street, Kennedy Boulevard, Nebraska Avenue and along Meridian Avenue to Channelside Drive** has a significant amount of queuing and congestion during the morning peak periods as well as during special events. Local downtown commuters, along with commuters exiting the REL to avoid paying further tolls cause significant congestion issues.

The Pilot plans to demonstrate the kinds of improvements that can be made in an urban environment. The Pilot is deploying site-tailored collections of applications that address specific local needs while laying a foundation for additional local/regional deployment and providing transferable lessons.

The Pilot will comprise THEA/City of Tampa (CoT) Combined TMC Operations, Hillsborough Area Regional Transit (HART) Bus Operations, CoT signal O&M, CV-Pilot System Development, CV-Pilot Design, Deployment and O&M, Key Agency Partners, Stakeholders and System Users, and Sustainability Models/Partners.

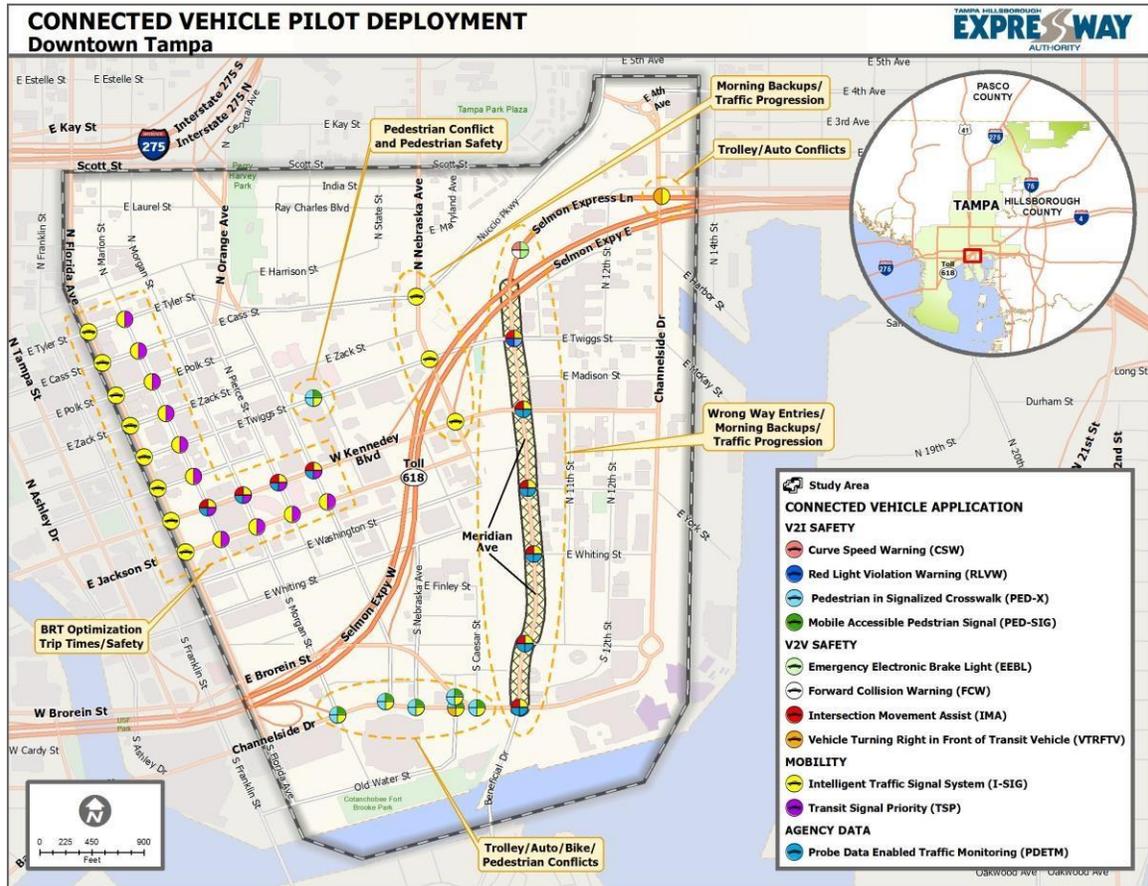
## 5.1 Geographic Boundaries

The Pilot, located in downtown Tampa, aims to create a connected urban environment to measure the effect and impact of CVs in Tampa's vibrant downtown. To the vision of a connected downtown, the Pilot will deploy several CV applications in Tampa's CBD; which is one square mile in size. This environment has a rich variety of traffic, mobility and safety situations that are amenable to vehicle to vehicle (V2V), vehicle to infrastructure (V2I) and vehicle to "everything" (V2X) solutions (e.g. smartphones). The deployment area is within a busy downtown and offers a tolled expressway with street-level interface, bus and streetcar service, high pedestrian densities, special event trip generators and high dynamic traffic demand over the course of a typical day. These diverse environments in one concentrated deployment area collectively encompass many traffic situations where CV technology can be used to address these situations. Figure 1 is an overview of the deployment area. Each deployment location is identified by a small circle. These circles denote where RSUs will be deployed. Within the circles are colors; using the legend one can see what applications will be deployed on the RSUs at those locations.

The deployment area is bordered by North Florida Avenue, Scott Street, and Channelside Drive. Within the deployment area the REL exit, Meridian Street, Twiggs Street, Kennedy Boulevard, and Marion Street show RSU locations in Figure 1.

5. Deployment Scope

Figure 1 THEA Deployment Area



Source: HNTB

The Pilot has the following traffic operations characteristics:

- THEA owns and maintains the TMC while the City of Tampa staffs the TMC.
- The City of Tampa operates and maintains signing and flashers at the mid-block crossing at the County courthouse. The City of Tampa also operates the parking garage across from the courthouse.
- THEA owns the Meridian Avenue roadway and the City of Tampa operates the Meridian Avenue signals.
- The City of Tampa owns the city streets with the exception of Meridian Avenue and operates the traffic signal system citywide.
- THEA owns and operates the Selmon Expressway, a primary route into downtown and to MacDill Air Force Base (MAFB).
- HART owns, maintains, and operates its transit operations center. HART operates an express route along and through the downtown city streets to the Marion Street Transit Station. The TECO Streetcar line is operated by HART.

## 5.2 Numbers of Vehicles/Devices/Roadside Equipment

This chapter provides the number and description of each deployment component for roadside equipment, onboard units, and pedestrian information devices.

**Table 5.1 Connected Vehicle Device Numbers**

Pilot Equipment	Planned Number Deployed
Roadside Units	40
Light Vehicle Onboard Units	1,500
Bus Onboard Units	10
Streetcar Onboard Units	10
Pedestrian application	500+
Vehicle Detectors	Tbd
Pedestrian Detectors	Tbd

The table below provides the location of the RSUs within the deployment region. The table uses the symbol “I” for standard vehicle detection infrastructure (e.g., loops). The term “Proxy” is applied in RSUs for unequipped vehicles, pedestrians and bicycles without nomadic devices, where traditional detection equipment (I) is used to “proxy” (i.e., represent) messages as if all are equipped so that the new vehicles are aware of the crash threats (see Comprehensive Deployment Plan (CDP) Section 3.3.2.2 for more detail (THEA, Task 12, CDP, September 2016)).

**Table 5.2 RSU and Application Locations**

Use Case	Location	HW Object	SW Application	
Morning Backup (includes queue data from RSU9)	REL 27.954404, -82.448805	RSU 1	V2I	CSW RLVW Proxy
		Detector, Curve	I	Vehicle Detection
		OBU	V2I V2V	CSW RLVW EEBL FCW
Wrong-Way Entry	Twiggs & Meridian 27.952315, -82.449056	RSU 2	V2I	I-SIG RLVW
		Detector, Right Turn	Agency	PDETM
		Detector, Entrance	V2V V2I	IMA RLVW
Pedestrian Safety	Twiggs & Courthouse 27.950822, -82.453815	RSU 40	V2I	Proxy
		Crosswalk Detector		
		Curbside Detector 1		
		Curbside Detector 2	I	I
		J Walk Detector 1		
J Walk Detector 2				
		OBU / PSD	V2V	PED-SIG PED-X I-SIG

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Use Case	Location	HW Object	SW Application	
Transit Signal Priority	Marion & Tvlr 27.952711, -82.458214	RSU 19	V2I	I-SIG
		OBU	V2I	TSP
	Marion & Cass 27.952015, -82.457876	RSU 20	V2I	I-SIG
		OBU	V2I	TSP
	Marion & Polk 27.951267, -82.457521	RSU 21	V2I	I-SIG
		OBU	V2I	TSP
	Marion & Zack 27.950531, -82.457215	RSU 22	V2I	I-SIG
		OBU	V2I	TSP
	Marion & Twiggs 27.949770, -82.456896	RSU 23	V2I	I-SIG
		OBU	V2I	TSP
	Marion & Madison 27.949011, -82.456561	RSU 24	V2I	I-SIG
		OBU	V2I	TSP
	Marion & Kennedv 27.948281, -82.456253	RSU 25	V2I	I-SIG
		Agency	V2V	PDETM
		OBU	V2I	IMA
	Marion & Jackson 27.947523, -82.455931	RSU 26	V2I	I-SIG
		OBU	V2I	TSP
	Morgan & Jackson 27.947806, -82.455082	RSU 27	V2I	I-SIG
		OBU	V2I	TSP
	Pierce & Jackson 27.948095, -82.454242	RSU 28	V2I	I-SIG
		OBU	V2I	TSP
	Jefferson & Jackson 27.948403, -82.453403	RSU 29	V2I	I-SIG
		OBU	V2I	TSP
	Morgan & Kennedy 27.948575, -82.455406	RSU 30	V2I	I-SIG
		Agency	V2V	PDETM
		OBU	V2I	IMA
	Pierce & Kennedy 27.948857, -82.454581	RSU 31	V2I	I-SIG
		Agency	V2V	PDETM
OBU		V2I	IMA	
Jefferson & Kennedy 27.949159, -82.453716	RSU 32	V2I	I-SIG	
	Agency	V2V	PDETM	
	OBU	V2I	IMA	
Streetcar Conflicts	Channelside & Morgan 27.943424, -82.453165	RSU 33	V2I	I-SIG
				PED Safety
	Channelside & Jefferson 27.943604, -82.452140	RSU 34	V2I	I-SIG
Channelside & Nebraska	RSU 35	V2I	PED-SIG	
			PED Safety	
			I-SIG	

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Use Case	Location	HW Object	SW Application
	27.943549, -82.451285		PED-SIG PED Safety I-SIG
	Channelside & Old Water 27.943525, -82.450382	RSU 36	V2I PED-SIG PED Safety VTRFTV I-SIG
	Channelside & Broroin 27.943755, -82.450395	OBU / PSD	V2V I-SIG PED-SIG PED Safety I-SIG
	Channelside & Caesar 27.943585, -82.449882	RSU 37	V2I PED-SIG PED Safety I-SIG
	Channelside & North 12th 27.955866, -82.445567	RSU 38	V2I PED-SIG PED Safety I-SIG
		RSU 39	V2I PED-SIG PED Safety VTRFTV
		OBU / PSD	V2V V2I I-SIG
	Kennedy & Meridian 27.950576, -82.449003	RSU 3	Agency PDETM
		OBU	V2V IMA
	Washington & Meridian 27.948732, -82.448792	RSU 4	V2I Agency PDETM
		OBU	V2V IMA
	Whiting & Meridian 27.947184, -82.448675	RSU 5	V2I Agency PDETM
		OBU	V2V IMA
	Cumberland & Meridian 27.945015, -82.448765	RSU 6	V2I Agency PDETM
		OBU	V2V IMA
	Channelside & Meridian 27.943557, -82.448889	RSU 7	V2I Agency PDETM
		OBU	V2V IMA
	Nebraska & Cass 27.953322, -82.451271	RSU 8	V2I I-SIG
	Nebraska & Twigg 27.947184, -82.448675	RSU 9	V2I I-SIG
	Nebraska & Kennedv 27.950303, -82.450353	RSU 10	V2I I-SIG
	Florida & Tvler 27.952442, -82.459046	RSU 11	V2I I-SIG
	Florida & Cass 27.951720, -82.458746	RSU 12	V2I I-SIG
	Florida & Polk 27.950953, -82.458412	RSU 13	V2I I-SIG
	Florida & Zack 27.950233, -82.458089	RSU 14	V2I I-SIG
	Florida & Twiegs 27.949471, -82.457758	RSU 15	V2I I-SIG
	Florida & Madison 27.948723, -82.457418	RSU 16	V2I I-SIG
	Florida & Kennedv 27.947969, -82.457035	RSU 17	V2I I-SIG
	Florida & Jackson 27.947229, -82.456796	RSU 18	V2I I-SIG
Traffic Progression			

# 6 Risk Assessment

During Phase 1, risks were identified and tracked using a risk register. Risks identified for Phase 2 and Phase 3 were added to the risk register. For completeness Phase 1 risks are included.

## 6.1 Key Technical Risks

### 6.1.1 Phases 1-3

Table 6.1 Phases 1-3 Risks

RISK #	TASK	RISK OWNER	RISK IDENTIFICATION	PROBABILITY (1-5)	IMPACT (1-5)	SEVERITY (P*I)	RISK RESPONSE	RISK MITIGATION STRATEGY	CLOSING RISK DATE
	Title or description of task.	Owner of risk.	Brief description of risk.	1 - Low 5 - High	1 - Low 5 - High	Formula calculated risk (Probability * Impact)	Avoid, Mitigate, Accept, Contingency, Transfer the risk.	Overall approach to reduce risk impact severity and or probability of occurrence.	
P1-1	ConOps / Schedule / System Requirements	THEA	Unknown system/device compatibility issues	2	2	4	Mitigate	Early engagement with FDOT- <b>Transportation Engineering Research Laboratory (TERL)</b> & Float in deployment schedule	ConOps 02/2016  TERL 09/2016

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P1-2	Program Management	THEA	Loss of Key Staff	2	1	2	Contingency	Succession Plan	Ongoing
P1-3	Stakeholder Education	THEA	Public Opposition / Privacy or safety concerns	2	2	4	Mitigate	Effective Outreach Plan	Ongoing
P2/3-1	Deployment Plan	THEA	Extended road closures - Planned private development	4	2	8	Mitigate	Close Coordination with CoT / Developer	Ongoing
P2/3-2	Deployment Plan	THEA / Stakeholder FDOT-D7	Conflicting Construction projects – (e.g., Managed Lanes 2018)	3	3	9	Mitigate	Close coordination with FDOT-D7 - Opportunity for shared cost.	Ongoing
P2/3-3	Deployment Plan	THEA / Partner CoT	Conflicting construction projects - CoT planned signal upgrades in pilot area	4	4	16	Mitigate	Close coordination with CoT (Pilot Partner) - Opportunity for shared cost.	Ongoing

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P2/3-4	Safety Plan / Outreach Plan	THEA / USDOT Pilots	Accident in pilot area with litigation.	1	5	5	Mitigate / Transfer	Mitigate risk through safety plan & outreach plan. Transfer financial risk via insurance	Ongoing
P1-4	ConOps / Schedule/ System Requirements	THEA	Pilot received training and webinars indicating use of CVRIA SET-IT tool to generate ConOps. Then first draft of ConOps was rejected because use of this tool made the ConOps too technical. A complete re-work was required and doubled projected effort for task deliverable and put schedule and budget in jeopardy.	5	5	25	Mitigate	The output of the SET-IT tool will have relevance in developing the system requirements. Will attempt to recoup "some" of the lost revenue through reduced effort on Task 6 by utilizing the SET-IT data and diagrams.	09/2016
P1-5	Deployment Plan	THEA/USDOT	Schedule risk due to BAA schedule of deliverables conflict. Task 6 is predecessor to Task 7 start but they have a concurrent deliverable date.	5	4	20	Remove	Identified risk and worked with USDOT to resolve via schedule update.	02/2016
P2/1	6.1.1 - Vendor Sourcing	Brand-Motion (BM)	6.1.1.1 RFQ - Requirements Definition: requirements not clear or well understood by the Vendors	2	5	10	Mitigate	Two step approach has been followed, RFI (request of information) followed by RFQ (request for Quotation) to engage vendors in a close communication with the in-vehicle integrator (BM).  A clarification session is foreseen after the RFQ package is issued, as part of RFQ process: 6.1.1.4 RFQ - Clarifications	Ongoing

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P2/2	6.1.1 - Vendor Sourcing	BM	6.1.1.1 RFQ - Requirements Definition: Requirements Incomplete can lead to underestimated development time for Human Machine Interface (HMI) and Apps.	2	3	6	Mitigate	The RFP Package includes planning with milestones for HMI and Apps and requests enough resources to ensure deliverables on time, in the worst case scenario.	Ongoing
P2/3	6.1.2 - In-Vehicle installation Kits Definition	BM	6.1.2.3 - Kitting : number of cars foreseen for the Pilot not covered by KITS (based on vehicle type)	1	4	4	Mitigate	Choose installation kits that cover main OEM Brands and vehicle types. Design an in-vehicle system which is not related to the specific vehicle Electronic Design.	Ongoing
P2/4	6.1.2.4 HMI Specification	BM	6.1.2.4.1 Interaction Strategy Definition based on vehicle typologies (CAR/streetcars/busses) : HMI Devices with required performances may not available off the shelf	1	4	4	Mitigate	The in-Vehicle DSRC system is modular (OBU-ANT-HMI) , this allows to use a wide range of devices as HMI (human-machine interface). For instance, Interior Rear Mirrors with Display/Speaker embedded are available for automotive industry standards.	Ongoing
P2/5	6.1.3 - OBUs SW Development	BM	Apps/Diag Software not ready on time for phase3	2	4	8	Mitigate	There are 4 phases of Verification planned (PROTO A,B,C and Final). This process will address any possible SW issues before phase 3. Issues found during one phase must be fixed before to start the following development phase. 6.1.3.X.1 Apps Modifications/Validation	Ongoing

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P2/6	6.1.3 - OBUs SW Development	BM	General vendor failure (company issues or inability to complete the task)	1	5	5	Mitigate	There will be multiple (at least 2) OBU vendors to ensure the coverage. Each Vendor can cover 100% of the OBU required.	Ongoing
P2/7	6.1.4 - Kit Installation and functional Verification	BM	6.1.4.1.1 - Definition of Installation Verification Procedure : verification on Streetcars and Busses can't be done at Hillsborough Community College (HCC) or BM facilities. It won't be possible to double verify the procedure during the development phases before final release	5	4	20	Mitigate	The general approach is to have an installation/verification procedure performed at the In-Vehicle integrator (BM) facility, and then mirror the same procedure as second step at HCC. Busses and Streetcars must be handled directly at TAMPA.	Ongoing
P3/1	6.2 - Tech. Support	BM	In case of in-vehicle malfunction, the system vehicle needs to be analyzed. The time needed to analyze the issue has an impact on the vehicle users (disservice).	3	5	15	Mitigate	The in-Vehicle DSRC system is modular (OBU-ANT-HMI). This allows a faster diagnosis of the issues. There will be a checklist to verify step by step connections and functionality of the system. The in-vehicle DSRC system is not connected to the vehicle system architecture (only POWER from IGNITION) to avoid any impact on the vehicle itself.	Ongoing

### 6.1.2 Roadside Equipment Technologies

Roadside Equipment consists of the Roadside Unit (RSU), the software application objects that reside in the RSU, plus cabinet equipment including Power over Ethernet (PoE) injector, network switch and communications backhaul

**Table 6.2 Roadside Equipment Technologies Risks**

RISK #	TASK	RISK OWNER	RISK IDENTIFICATION	PROBABILITY (1-5)	IMPACT (1-5)	SEVERITY (P*I)	RISK RESPONSE	RISK MITIGATION STRATEGY	CLOSING RISK DATE
	Title or description of task.	Owner of risk.	Brief description of risk.	1 - Low 5 - High	1 - Low 5 - High	Formula calculated risk (Probability * Impact)	Avoid, Mitigate, Accept, Contingency, Transfer the risk.	Overall approach to reduce risk impact severity and or probability of occurrence.	
R-1	RSU Certification	Siemens	The December 2016 period of performance ends before the contracted RSU certification test procedures are completed	5	3	15	Contingency	Siemens completes the certification test procedure documents as a Level Test Plan without additional funding	Ongoing
R-2	RSU Specifications	Siemens	USDOT RSU Requirements Specifications v4 is superseded	5	2	10	Accept	RSU software stack is updated to v4.1 with associated schedule delays	Ongoing
R-3	RSU Interoperability	Siemens	Multiple RSU manufacturers differ in interpretation of standards, creating interoperability issues	5	2	10	Avoid	Siemens will supply a single version of the RSU without mixing multiple manufacturers	06/2016
R-4	RSU Security	Siemens	Total RSU security, particularly the FIPS levels could be prohibitively expensive if hardware redesign is required	5	2	10	Accept	Siemens Cyber security group conducts security scans of one RSU type to mitigate the cost of multiple devices. Issues are addressed in order of threat severity divided by cost within the available budget.	06/2016

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R-5	RSU SPAT Reference Implementation	Siemens	"Black Box" Windows software ported to Linux on contract to USDOT is not available on the OSADP or is found to be defective	1	3	3	Mitigate	Siemens obtains the unfinished version, completes and tests in the selected RSU	Ongoing
R-6	OEM incompatibility	Siemens, Brand Motion	OEM vehicles sold in Jan 2017 are incompatible with test sites installed in 2018	5	5	25	Mitigate	Siemens and Brand Motion collaborate on Level Test procedures with CAMP and OEMs	Ongoing
R-7	Pilot Site Incompatibility	Siemens, Brand Motion	Aftermarket equipped test vehicles are incompatible with the New York City and Wyoming Pilot sites	5	5	25	Mitigate	Identical RSUs and roadside applications residing in the RSUs for all Pilot sites. THEA site has proposed an equipment swap among sites for early testing and USDOT has planned for a plugfest for potential vendors.	Ongoing
R-8	RSU SW App Availability	Siemens	Several RSU SW applications are not available on the OSADP	5	2	10	Contingency	Siemens supplies the missing RSU apps on distribution license that were previously developed for other projects	Ongoing
R-9	Open Source Applications	Siemens	Open Source software applications on the OSADP are fixed in function for the field test sites	5	2	10	Mitigate	Siemens replaces hard-coded constants with configurable fields	Ongoing
R-10	Privacy vs Researcher Needs	Siemens	Penetration of unequipped vehicle greatly exceeds equipped vehicles	4	1	4	Mitigate	Siemens will install traditional vehicle and pedestrian detection to proxy BSMs for unequipped vehicles	Ongoing

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R-11	Privacy vs Researcher Needs	Siemens	Needs of researchers to know vehicle info infringes on privacy	4	1	4	Mitigate	Siemens will use the BSM size field to classify vehicles in to research categories broad enough to insure privacy, such as Equipped, Unequipped (proxied) and Control	Ongoing
R-12	RSU Management	Siemens	Maintaining RSUs involves driving to each RSU to update software or to monitor performance	5	1	5	Mitigate	As part of the Master Server, Siemens will provide RSU management software with maps to monitor and update RSUs	Ongoing
R-13	SPAT Overlap	Siemens	Closely-spaced (within 300M) RSUs will receive SPAT and MAP from other RSUs.	5	1	5	Mitigate	As part of the Master Server, Siemens will provide RSU management software with maps to set geofences. All SPAT will be received, only the geofenced SPAT will be active	Ongoing
R-14	BSM Overlap	Siemens	Closely-spaced (within 300M) RSUs will receive duplicate BSMs from nearby vehicles	5	1	5	Mitigate	As part of the Master Server, Siemens will provide RSU management software with maps to set geofences. All BSMs will be received, only the geofenced BSMs will be active	Ongoing

### 6.1.3 Back Office Technologies

Back office consists of a Master Server that manages the RSUs and also collects data from the RSUs to be accessed by the Researchers and Law Enforcement during Phase 3

**Table 6.3 Back Office Technologies Risks**

RISK #	TASK	RISK OWNER	RISK IDENTIFICATION	PROBABILITY (1-5)	IMPACT (1-5)	SEVERITY (P*I)	RISK RESPONSE	RISK MITIGATION STRATEGY	CLOSING RISK DATE
	Title or description of task.	Owner of risk.	Brief description of risk.	1 - Low 5 - High	1 - Low 5 - High	Formula calculated risk (Probability * Impact)	Avoid, Mitigate, Accept, Contingency, Transfer the risk.	Overall approach to reduce risk impact severity and or probability of occurrence.	
B-1	Data Clearinghouse Latency	Siemens	Data clearinghouse latency exceeds crash avoidance requirements	5	1	5	Avoid	Data associated with crash avoidance remains local between OBUs, PSDs and RSUs. The resulting alerts and warnings are sent to Master Server for availability to the Data Warehouse and law enforcement	Ongoing

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B-2	Data Privacy Needs vs Researcher Needs	Siemens	Researchers need vehicle and ped information for research, participants need privacy	5	1	5	Avoid	BSM size field normally used for vehicle classification is used to categorize BSMs into broad categories that cannot be tracked to an individual person or vehicle, such as Equipped, Proxied and Personal Device	Ongoing
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### 6.1.4 Mobile Device Technologies

Mobile devices consists of personally-owned smart phones based on the Android operating system

**Table 6.4 Mobile Device Technologies Risks**

RISK #	TASK	RISK OWNER	RISK IDENTIFICATION	PROBABILITY (1-5)	IMPACT (1-5)	SEVERITY (P*I)	RISK RESPONSE	RISK MITIGATION STRATEGY	CLOSING RISK DATE
	Title or description of task.	Owner of risk.	Brief description of risk.	1 - Low 5 - High	1 - Low 5 - High	Formula calculated risk (Probability * Impact)	Avoid, Mitigate, Accept, Contingency, Transfer the risk.	Overall approach to reduce risk impact severity and or probability of occurrence.	
P-1	IOS Unavailable	Siemens	Apple IOS devices require use of Apple API and Apple App store	5	1	5	Avoid	Participants will be selected that already own Android devices that do not require API and can be updated from a private server, in this case, the Master Server	06/2016

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P-2	GPS Inaccuracy	Siemens	GPS accuracy of Android PSD devices is not sufficient for crash avoidance	5	1	5	Mitigate	Accurate pedestrian detectors are installed at the ped safety sites. Accurate ped locations will be reported along with PSD GPS location. The RSU will use the detector data for crash avoidance, but report both the detector data and GPS data to the Master Server for the researchers	06/2016
P-3	PSD Battery Life	Siemens	Battery life of Android devices is degraded by continuous use of the ped safety app	5	1	5	Mitigate	App will "wake up" on short duty-cycles to preserve battery life. During the short wake-up periods, the app will go back to sleep if no RSU is detected, not in range. If an RSU is detected nearby, the app will remain awake and send PSMs	Ongoing

### 6.1.5 Vehicle Onboard Technologies

This section shall provide feasibility assessment covering acquisition of key technologies and assets (vehicles and other equipment) in volumes associated with the planned effort.

**Table 6.5 Vehicle Onboard Technologies Risks**

RISK #	TASK	RISK OWNER	RISK IDENTIFICATION	PROBABILITY (1-5)	IMPACT (1-5)	SEVERITY (P*I)	RISK RESPONSE	RISK MITIGATION STRATEGY	CLOSING RISK DATE
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	Title or description of task.	Owner of risk.	Brief description of risk.	1 - Low 5 - High	1 - Low 5 - High	Formula calculated risk (Probability * Impact)	Avoid, Mitigate, Accept, Contingency, Transfer the risk.	Overall approach to reduce risk impact severity and or probability of occurrence.	
S-1	POC SMCS Availability	USDOT (NHTSA) & CAMP	The fully functional SCMS is not available in time for Pilot testing and development, including all extensions associated with V2I Components	3	4	12	Contingency	Utilize SCMS from Safety Pilot (including all limitations) or do not use SCMS until its ready.	Ongoing
S-2	POC SCMS Design	USDOT (NHTSA) & CAMP	The full suite of SCMS design documents is not made available in a timely fashion to the pilot sites and technology developers and vendors to allow them to begin the process of incorporating the full SCMS design	1	3	3	Contingency	Do not use security until devices are available (disable all warnings, etc.)	Ongoing
S-3	Misbehavior Detection	USDOT (NHTSA) & CAMP	Misbehavior detection is not developed (or not thoroughly developed) resulting in the inability to create a CRL and to automatically remove devices from the pilot	4	1	4	Accept	Do not test CRL functionality in Pilot. Added training to users that false warnings are more likely.	Ongoing
S-4	On-Board Equipment (OBE) Certification		Current certification plan only covers Roadside Equipment (RSEs) and not OBEs. Security compliance and interoperability with SCMS will need to be self-certified	5	3	15	Mitigate	USDOT create a QPL for OBEs that are certified and interoperable or include additional funding for the pilot site to perform additional interoperable testing. Pilot site to add additional requirements documenting certification processes and results and test results of interactions with POC SCMS	Ongoing
S-5	Security Credential Control		There are 3 formal pilots plus others (ACTIVE, USDOT Test bed, etc.) plus the official SCMS being deployed to support GM. Assuming one SCMS Root, who is the ultimate decision maker on distributing credentials? Risk associated with having no control over security material being distributed.	3	1	3	Mitigate	USDOT(?) to serve as (appoint?) security credential control oversight.	Ongoing

6. Risk Assessment

S-2	POC SCMS Design	USDOT (NHTSA) & CAMP	The full suite of SCSM design documents is not made available in a timely fashion to the pilot sites and technology developers and vendors to allow them to begin the process of incorporating the full SCMS design	1	3	3	Contingency	Do not use security until devices are available (disable all warnings, etc.)	Ongoing
S-6	SCMS Operations	USDOT (JPO)	POC SCMS Testing is currently software only. Pilots will require a full end-to-end test that includes requesting and downloading certificates over the air at RSEs. This has not been tested. Risk is that the distribution of security materials fails and after bootstrap, devices never get renewed credentials.	3	4	12	Contingency	Generate credentials off-line and download them to the devices manually either through media or other off-line distribution method.	Ongoing
S-7	RSU Availability		RSU cannot support signing of messages	2	4	8	Contingency	Do not include functionality in pilot	Ongoing
S-8	OBU Availability		OBU cannot support signing or confirmation of signed messages	2	4	8	Contingency	Do not include functionality in pilot	Ongoing
S-9	OBU CRL Functionality		OBU's not available that support CRL functionality	4	1	4	Accept	Do not include functionality in pilot	Ongoing
S-10	OBU Download		OBU does not support download of security credentials "on the fly"	2	4	8	Contingency	Generate credentials off-line and download them to the devices manually either through media or other off-line distribution method.	Ongoing

## 6.2 Key Institutional Risks

Table 6.6 Key Institutional Risks

6. Risk Assessment

RISK NUMBER	TASK	RISK OWNER	RISK IDENTIFICATION	PROBABILITY (1-5)	IMPACT (1-5)	SEVERITY (P*I)	RISK RESPONSE	RISK MITIGATION STRATEGY	CLOSING RISK DATE
	Title or description of task.	Owner of risk.	Brief description of risk.	1 - Low 5 - High	1 - Low 5 - High	Formula calculated risk (Probability * Impact)	Avoid, Mitigate, Accept, Contingency, Transfer the risk.	Overall approach to reduce risk impact severity and or probability of occurrence.	
I-1	Standards Stability	Siemens	Multiple layers of standards are constantly changing	5	4	20	Mitigate	Siemens will select a baseline of currently-published standards that meet the needs and requirements. Future changes to this baseline that do not affect safety or interoperability will be avoided.	Ongoing
I-2	DSRC Band	Siemens	Pilot is designed using the current FCC-allocated DSRC channels, while others are trying to take the bands for other uses	5	4		Accept	Pilot will be designed to the current DSRC channels and will lobby to retain the channels, since the advent of AV will require use of the additional channels	06/2016
I-3	Law Enforcement	Siemens	Law Enforcement is not a current stakeholder, but will benefit from the wrong-way alerts	5	2		Mitigate	Wrong-way alerts will be logged in the Master Server, for later availability to Law Enforcement	Ongoing

# References

- THEA. (Task 2, ConOps, February 2016). *Connected Vehicle Pilot User Oriented Concept of Operations - Tampa, FHWA-JPO-16-311*. Federal Highway Administration, USDOT.  
<http://ntl.bts.gov/lib/57000/57000/57032/FHWA-JPO-16-311.pdf>.
- THEA. (Task 3, SMOC, April 2016). *Connected Vehicle Pilot Privacy and Security Mangement Operating Concept - Tampa, FHWA-JPO-16-312*. Federal Highway Administration, USDOT.
- THEA. (Task 4, Safety, April 2016). *Connected Vehicle Pilot Safety Management Plan - Tampa, FHWA-JPO-16-313*. Federal Highway Administration, USDOT.
- THEA. (Task 5, PMESP, July 2016). *Connected Vehicle Pilot Performance Measurement and Evaluation Support Plan - Tampa, FHWA-JPO-16-314*. Federal Highway Administration, USDOT.
- THEA. (Task 6, SyRS, September 2016). *Connected Vehicle Pilot System Requirements Specification - Tampa, FHWA-JPO-16-315*. Federal Highway Administration, USDOT.
- THEA. (Task 7, ADP, September 2016). *Connected Vehicle Pilot Application Deployment Plan - Tampa, FHWA-JPO-16-316*. Federal Highway Administration, USDOT.
- THEA. (Task 8, HUA, July 2016). *Connected Vehicle Pilot Human Use Approval Plan - Tampa, FHWA-JPO-16-317*. Federal Highway Administration, USDOT.
- THEA. (Task 9, PTSEP, August 2016). *Connected Vehicle Pilot Participant Training and Stakeholder Education Plan - Tampa, FHWA-JPO-318*. Federal Highway Administration, USDOT.
- THEA. (Task 10, Partnerships, August 2016). *Connected Vehicle Pilot Partnership Coordination and Finalization - Tampa, FHWA-JPO-16-319*. Federal Highway Administration, USDOT.
- THEA. (Task 11, Outreach, Draft - July 2016). *Connected Vehicle Pilot Outreach Plan – Tampa, FHWA-JPO-16-320*. Federal Highway Administration (FHWA), USDOT.
- THEA. (Task 12, CDP, September 2016). *Connected Vehicle Comprehensive Deployment Plan - Tampa, FHWA-JPO-16-321*. Federal Highway Administration, USDOT.



This Interlocal Agreement (the "Agreement") is made and entered into this \_\_\_\_\_ day of February, <sup>AO!/'</sup> by and between the CITY OF TAMPA (the "City"), whose address is 315 East Kennedy Boulevard, Tampa, Florida 33602, and the TAMPA-HILLSBOROUGH COUNTY EXPRESSWAY AUTHORITY (the "Authority"), whose address is 412 East Madison Street, Suite 800, Tampa, Florida 33602.

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RECITALS:

- A. WHEREAS, the Florida Interlocal Cooperation Act of 1969, Chapter 163, Part 1, Florida Statutes, authorizes government units to cooperate and make the most effective use of their powers and resources; and
- B. WHEREAS, in the interest of public safety and convenience, the Authority intends to construct roadway improvements for the establishment of its Reversible Express Lanes Project ("Project"); and
- C. WHEREAS, the Authority owns and manages a building for the operation of the Project and its administrative offices (the "Building"); and
- D. WHEREAS, the Authority acquired three (3) parcels of real property from the City as more particularly described on attached Exhibit "A" (the "Land"), one of which serves as the location for the Building. As of the date of this agreement the parties have not yet agreed to the total compensation for such Land, which is the subject of that certain action identified as Hillsborough Circuit Court Case No. 02-8767, Div "I", Parcel 206A, herein the "Pending Litigation"; and

E. WHEREAS, the parties recognize that there is an overriding public purpose in proceeding with this Agreement and in separately and independently, without delaying this matter, determining the value of the Land and of the City's rights of occupancy and use of the TMC (as later defined) net of additional City operating costs for providing lane switching for the project; and

F. WHEREAS, the portion of the Building, shown as the "Traffic Management Center" on Exhibit "B" attached hereto and made a part hereof, will be used as a traffic management center by the City (the "TMC" or "Traffic Management Center") for the operation and management of the City's roadways and the switching of the Authority's Project; and

G. WHEREAS, it is the intent of the City and Authority that upon completion of construction of the Project, daily operation of switching the reversible lanes shall be managed and administered by the City.

NOW, THEREFORE, in consideration of the parties' mutual covenants and promises contained herein, and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Authority and the City agree as follows:

1. Recitals. All of the foregoing recitals are hereby ratified and confirmed by each of the parties as being true and correct and are hereby incorporated into the body of this Agreement.

2. Construction of Traffic Management Center. The Authority shall construct the Traffic Management Center within the Building which shall, at time of occupancy, include: a) state of the art control room, b) computer facilities, c) uninterrupted power

supply, d) backup electrical generator, and (e) video switch/server for City of Tampa **CCTV cameras. The City has participated in the design of the interior offices of the** TMC and accepts them as constructed.

3. TMC Operators The City agrees that the operators of the TMC must be City employees who are properly trained and authorized to operate the City's traffic signalization system and administration and operation of the Authority's Reversible Express Lanes Project (the "TMC Operators").

4. Reversible Lanes Administration. Recognizing that the flow of traffic into and out of the City of Tampa resulting from the Project will require coordinated administration by the City, it is hereby agreed by the parties that upon completion of the Project the City shall assume the daily operation, management and administration of the **process of switching the reversible lanes. Reversible lane management and switching**

operations shall be administered pursuant to the attached Memorandum of Reversible Lanes Operating Procedure and Resoonsibilities ("The Ops Manual"), marked Exhibit "C". The Ops Manual may be updated and revised administratively by the City and Authority as necessary, contingent, however, that each updated and revised version the Ops Manual must be recorded in the Office of the Clerk of Circuit Court for **Hillsborough County. Each revised Ops Manual shall reference this agreement as** authority therefore and shall contain the signature of the chief executive of each agency. The last recorded version of the Ops Manual shall control and all previous versions shall be deemed replaced and supplanted immediately upon recording of the revised manual. The Authority shall at all times remain responsible for maintenance, repair and capital improvements of the Project.

5. Use of TMC and Building.

(a) *Space Allocation to City:* The Authority grants the City four thousand (4,000) net useable square feet to be used by the City (the "City-TMC Space") as office space for monitoring and control of City traffic operations and Reversible Lanes Project administration. The Authority and City recognize the complexities involved in relocating these facilities and hereby agree to coordinate the relocation and compatibility of equipment and necessary infrastructure.

(b) *20-year Term of Agreement:* The Authority grants the City right to use the TMC for the period commencing on the date of occupancy of the Building and ending twenty (20) years from the date of occupancy (the "Term"), subject to the terms and conditions set forth herein, for the sole purpose of operating, monitoring and managing the City's traffic signalization systems and switching the Authority's Reversible Express Lanes and no other purpose without the Authority's prior written consent.

(c) *Date of Occupancy:* **The City shall have the right to enter upon and occupy** the City-TMC Space on March 1, 2006, or on such earlier date as may be mutually agreed by the parties.

(d) *Use of Common Areas, Parking:* The Authority shall allow the City TMC Operators to have access to the common areas of the Building, including conference and break rooms ("Common Areas"), during the Term, subject to Authority's rules and procedures applicable to all users, tenants or occupants of the building, as may be adopted or amended from time to time, relating to scheduling and use of such areas. The City shall at all times during the term of this agreement have the right to two (2) permanently dedicated parking spaces for City vehicles. The City shall provide, install

and maintain signage for the two (2) designated parking spaces. Neither the City, nor its licensees, agents, successors or assigns, shall use the TMC or Common Areas (collectively, the "Premises") for any purpose that would be unlawful or constitute a nuisance or interfere in any way with the use and occupancy of any other part of the Building by the Authority or its tenants, licensees, successors or assigns. The Authority will also provide all cubicles and furniture for use by the TMC Operators within the Traffic Management Center. The City shall provide all computers, printers, and other equipment required by the TMC Operators to perform their duties.

6. **Compensation; Utilities.** In consideration of the services provided by the City, the City shall have no rental obligation for the term of this agreement. The Authority shall be responsible for all utility expenses (electric, water, gas etc.), except that the City shall be responsible for any and all telecommunications expenses (cable TV, telephone, internet, etc.) related to the City's use of the TMC facilities

7. **Operation of Traffic Management Center.** The TMC Operators shall operate ITS, the gates, variable signs, and the traffic signs necessary for the safe and efficient operation of the Project from the TMC. The TMC Operators may also operate the traffic signals and control devices for the City's roadways from the TMC. As provided in the attached memorandum, the Authority agrees to coordinate the Reversible Lanes Schedule with the City's Traffic Management Department. The parties agree to cooperate concerning the switching of the Project and explore options to share traffic management facilities and costs.

8. **Reservation of Rights (Pending Litigation).** The City and the Authority agree that any amounts owed to the City by the Authority for the Land arising from the

Pending Litigation shall be handled separately. In connection therewith, City and Authority agree that the fair market value of the City's right of use with respect to the TMC as set forth herein, less the actual costs of the services provided by the City, as described herein, shall be applied against the value of the Land in order to determine any additional amount due to the City under the Pending Litigation. City's actual costs shall include such items as salary, benefits, employer contributions and any equipment or machinery provided by the City for the purpose of operating the Project. Said cost shall be calculated for the entire proposed term of this agreement using generally recognized accounting assumptions, principles and standards.

9. Indemnification by the Authority. To the extent permitted by applicable law, the Authority hereby agrees to indemnify and to hold the City harmless from and against any and all claims, suits, liability, costs, losses or expenses of any nature (including reasonably attorneys' fees, whether incurred at trial or on appeal) arising in connection with the operation, maintenance, repair and regulation of the Project by the Authority or in connection with the operation by the City and/or the TMC Operators of the traffic control signals as it relates with the switching of the Project by the Authority, except for such claims, suits, liability, costs, losses or expenses caused by the sole negligence or willful misconduct of the City. Notwithstanding any provision of this Agreement to the contrary, the City and the Authority agree that while the City shall cooperate with the Authority in connection with the switching of the Project, the proper and safe switching of the Project shall be the sole and exclusive responsibility of the Authority. Further, the Authority shall be responsible for the cost and operation of all special traffic control devices required in connection with the Project by the Authority.

10. Indemnification by the City. The City covenants and agrees to defend and indemnify the Authority, its directors, officers, employees, successors and assigns and hold them harmless from any and all liability, damages, claims, costs, or expenses, including attorneys' fees, arising from: any act, omission, or negligence of the City, its **officers, contractors, licensees, tenants, agents, servants, employees, guests,** occupants, invitees, or visitors within or about the Land or Building; or any loss, accident, injury, or damage to any person or property sustained by the City or other persons, caused by theft, or by any act, omission, or negligence of the City or its officers, contractors, licensees, tenants, agents, servants, employees, guests, occupants, invitees, or visitors, including, without limitations, any and all environmental damages, claims, costs, and expenses due to the contamination, spill, release or discharge of hazardous materials, hazardous wastes or other contaminants occurring in or about the Premises; or any use of the Land or Building under this Agreement, except for any such claim caused by the sole negligence or willful misconduct of the Authority or any agent or employee of the Authority.

11. Entire Agreement. This Agreement embodies the whole agreement of the parties. There are no promises, terms, conditions, or obligations other than those **contained herein, and this Agreement shall supersede all previous communications,** representations, or agreements, either verbal or written, between the parties hereto.

12. Severability. It is understood and agreed by the parties hereto that if any part, term, or provision of this Agreement is by the courts held to be illegal or in conflict with a law of the State of Florida, the validity of the remaining portions or provisions shall not be

affected, and the rights and obligations of the parties shall be construed and enforced as if the Agreement did not contain the particular part, term or provision held to be invalid.

13. Notices. All notices required to be given to the Authority and the City hereunder shall be sent in writing to their respective addresses set forth herein, or to such other addresses as the parties may direct from time to time by written notice in accordance with **this paragraph, by (a) registered or certified mail, whereupon notice shall be deemed to** have been given on the third day after deposit for mailing; or (b) delivery (i.e., courier or other hand delivery), or overnight delivery, whereupon notice shall be deemed to have been given on the day of delivery. If the day of notice is a Saturday, Sunday, or legal holiday, notice shall be deemed to have been given on the first calendar day thereafter which is not a Saturday, Sunday, or legal holiday.

14. Default. If either party to this Agreement has reason to believe that it or the other party is in default of any provision of this Agreement, the party shall promptly notify in writing the other party. Such notification shall specify in reasonable detail the facts and circumstances constituting the default. Promptly upon receipt of such notification, the parties shall consult with each other as to what steps shall be taken to cure the default or to mitigate or remedy consequences thereof. If no resolution is achieved within thirty days after the receipt of such notice, the non-defaulting party shall be free to exercise whatever rights it has under this Agreement or at law or in equity.

15. Modification or Amendment. This Agreement may not be modified or amended except by a written agreement signed by authorized representatives of the Authority and **the City, provided, however, that in the interest of health, safety and welfare of the public,**

The Ops Manual may be amended from time to time as necessary in the manner provided herein

16. Counterparts. This Agreement may be executed in any number of counterparts and by different parties hereto by separate counterparts, each of which when so executed shall be deemed to be an original and all of which taken together shall constitute one and the same Agreement.

17. Recording and Effective Date. As required by Section 163.01(11), Florida Statutes, upon execution by the Parties this Agreement shall be recorded with the Clerk of the Circuit Court of Hillsborough County, Florida. The City shall record this Agreement. This Agreement shall be effective upon recording.

18. Fees and costs. Should any of the terms of this Agreement, except paragraph 8, require enforcement, the prevailing party shall be entitled to reasonable attorney's fees and court costs. Any costs, fees and expenses, including but not limited to attorneys fees, with regard to paragraph 8 shall be addressed and resolved in proceedings related to the Pending Litigation.

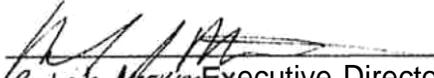
19. Non-Assignability. Neither the City nor the Authority may assign any rights or obligations under this Agreement without the prior written consent of the other. Any purported assignment of rights or obligations in violation of this section is void.

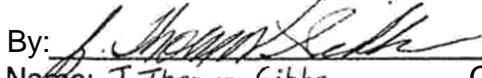
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IN WITNESS WHEREOF, the parties have hereunto affixed their hands and seals effective as of the date above.

**ATTEST:**

**TAMPA-HILLSBOROUGH COUNTY EXPRESSWAY AUTHORITY**

  
Ralph Mervine Executive Director

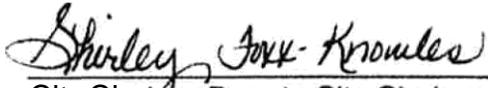
By:   
Name: J. Thomas Gibbs, Chair»•

Approved as to form:

  
Steve Anderson Esq. General Counsel

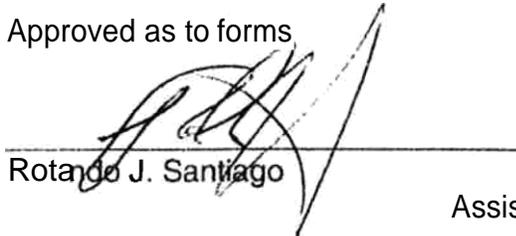
**ATTEST:**

**CITY OF TAMPA**

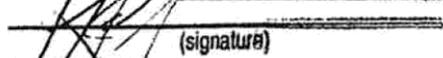
  
City Clerk or Deputy City Clerk

By: \_\_\_\_\_,  
**Pam Iorio, Mayor**

Approved as to forms

  
Rotando J. Santiago  
Assistant City Attorney

The execution of this document was authorized by Resolution No. 2006-943 & 2006-158

  
(signature)

City Attorney  
 Assistant City Attorney

State of Florida  
County of Hillsborough

This is to certify that the foregoing is a true and correct copy of the original on file on my office  
Witness my hand and official seal this 3<sup>rd</sup> day of March, 2006

  
CITY CLERK / DEPUTY CITY CLERK

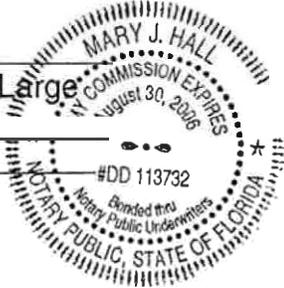
TAMPA-HILLSBOROUGH COUNTY EXPRESSWAY AUTHORITY  
NOTARY ACKNOWLEDGMENT

STATE OF FLORIDA  
COUNTY OF HILLSBOROUGH

The foregoing instrument was **acknowledged before** me this        " **day**  
of December, 2005, by T. Thomas Gibbs  
as Chairman of the Tampa-Hillsborough County Expressway Authority, who  is  
personally known to me or        presented         
as identification and did not take an oath.

Seal:

Name: Mary J. Hall  
Notary Public, State of Florida at Large  
Serial Number:         
Commission Expires:       

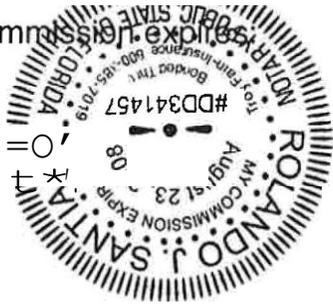


CITY OF TAMPA  
NOTARY ACKNOWLEDGMENT

STATE OF FLORIDA  
COUNTY OF HILLSBOROUGH

The foregoing instrument was acknowledged before me this 15<sup>th</sup> day  
of February, 2005, by         
as **Mayor of the City of Tampa**, who  is personally known to        r        presented  
as identification        di n t take an oath.

My commission expires       



Nam        o/o Z  
Not Public, State of Florida at Large  
Serial Number:

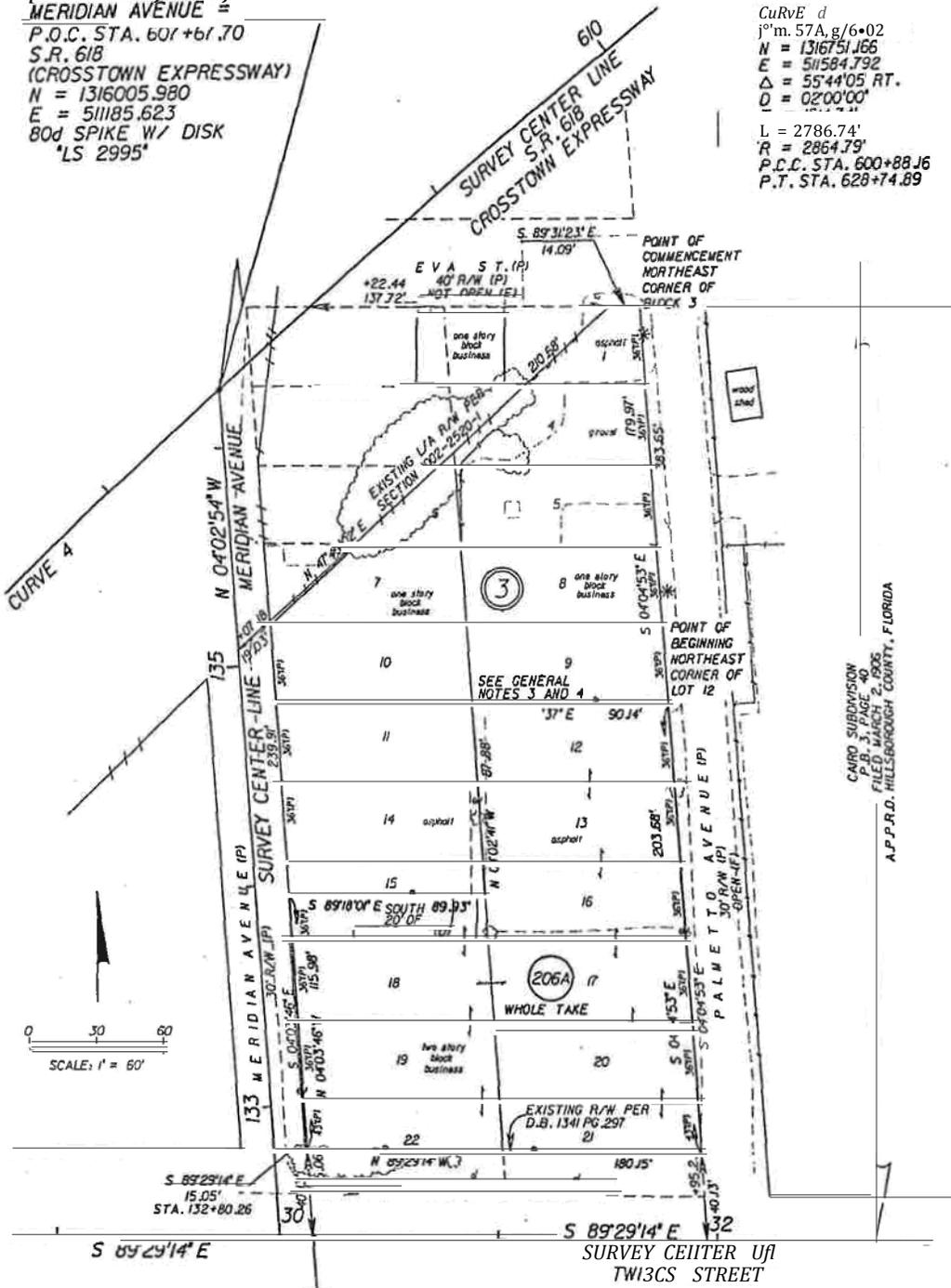
Exhibit "A"  
"The Land"

LEGAL DESCRIPTION OF TRAFFIC MANAGEMENT CENTER PARCEL



pD.T. str». ij6•£6JE  
 MERIDIAN AVENUE =  
 P.O.C. STA. 601+61.70  
 S.R. 618  
 (CROSSTOWN EXPRESSWAY)  
 N = 1316005.980  
 E = 51185.623  
 80d SPIKE W/ DISK  
 \*LS 2995\*

CuRvE d  
 j°m. 57A, g/6•02  
 N = 1316751.166  
 E = 511584.792  
 Δ = 55°44'05" RT.  
 D = 02°00'00"  
 L = 2786.74'  
 R = 2864.79'  
 P.C. STA. 600+88.16  
 P.T. STA. 628+74.89



CAIRO SUBDIVISION  
 P.B. 3, PAGE 40  
 FILED MARCH 2, 1936  
 A.P.P.R.D. HILLSBOROUGH COUNTY, FLORIDA

SEE sHffr waaRwrrmmvfAm NOTES  
 NOT A SURVEY  
 TaktPA - H I LLSBOROUGH COUNTY  
 Ex nEss>xx •urHonIrx

LEGAL DESCRIPTION AND SKETCH			
STATE ROAD NO • 618		HILLSBOROUGH COUNTY	
BY	DATE	APPROVED BY	DATE
PRELIM	G. JONES   3-02-02		
FINAL	G. JONES   6-03-02		
CHECKED	B. POTTER   6-03-02		
MAPS PREPARED BY		FIELD BOOK NO. 'S	
AIM ENGINEERING & SURVEYING, INC.		NOT APPLICABLE	
SCALE: 1" = 60'			

AIM ENGINEERING & SURVEYING, INC.  
 2900 115th Ave N  
 P.O. Box 1238  
 Littleton, CO 80120  
 (303) 733-1100  
 1-800-338-1100  
 Fax: 303-733-1100

REVISION	BY	DATE

LEGAL DESCRIPTION

That portion of Lots 1, 2, 3 and 4, Block 7, on ...  
 Block 6, Finley and Jones Subdivision, lying in Section 18, Township 29  
 South, Range 19 East, as per plat recorded in Plat Book 1, Page 93,  
 Public Records of Hillsborough County, Florida, and that part of Division  
 Street known closed as per Ordinance No. 571 lying northeasterly of said  
 Lot 1 and northwesterly of the northwesterly right of way line of Meridian  
 ... being ... particularly described as follows:

COMMENCE at survey center line  
 being survey center line station  
 the Right of Way Control Survey for State Road 618 prepared for the  
 ... Authority by AIM Engineering and  
 Surveying, Incorporated (AIM ... point being the beginning  
 of a nontangent curve concave southerly; ... said survey center  
 line of State Road 618 being the arc of said curve to the right, having a  
 radius of 2864.79 feet, a central angle of 03°02'51", the chord for which  
 bears N 48°44'10" E, a chord distance of 152.36 feet, an arc distance of  
 152.38 feet to survey center line station ...  
 said survey center line N 39°44'24" W, 114.10 feet to the POINT OF  
 BEGINNING; said point being on the existing northwesterly right of way  
 line of Meridian Avenue as per Deed Book 216 Page 192, Public Records of  
 Hillsborough County, Florida; thence N 38°27'48" E along said existing  
 northwesterly right of way line of Meridian Avenue, 329.71 feet to the  
 ... of Lot 5, Block 6, Finley and Jones Subdivision, as

Jones Subdivision, having a radius of 950.00 feet, a central angle of  
 13°55'01", the chord for which bears S 25°49'33" W, a chord distance of  
 270.19 feet, an arc distance of 230.75 feet; thence continue along the  
 westerly line of said Lots 2, 3 and 4, Block 7, S 18°15'03" W, 72.56 feet,  
 OF BEGINNING.

Said parcel contains 19149 square feet, more or less.

GENERAL NOTES

1. THE BEARINGS AND COORDINATES SHOWN HEREON ARE BASED ON THE FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE, 1983 NORTH AMERICAN DATUM, 1983 ... OF ... THE SURVEY CENTER LINE OF ... STATION 134+00.00 TO STATION 134+25.52.
2. THIS LEGAL DESCRIPTION AND SKETCH WAS PREPARED WITH THE BENEFIT OF THE OWNERSHIP AND ... OF THE COMMONWEALTH LAND TITLE ...

LEGEND

- A.P.P.R.D. = AS PER PUBLIC RECORDS OF PG. = PAGE
- D.B. = DEED BOOK
  - L = LENGTH OF CURVE
  - L/A = LIMITED ACCESS
  - N.T.S. = NOT TO SCALE
  - NO. = NUMBER
  - P.B. = PLAT BOOK
  - P.C. = POINT OF CURVATURE
  - P.C.C. = POINT OF CURVATURE CURVATURE
  - P.I. = POINT OF INTERSECTION
  - PT = POINT OF TANGENCY
  - PT = POINT ON CURVE
  - PT = POINT ON TANGENT
  - ST. = STREET
  - STA. = STATION
  - T = TANGENT LENGTH OF CURVE
  - E = EASTING STATE PLANE COORDINATE VALUE
  - N = NORTH STATE PLANE COORDINATE VALUE
  - Δ = DELTA (CENTRAL ANGLE)
  - CD = DEED DATA
  - FD = FIELD DATA
  - PL = PLAT DATA
  - PL = PROPERTY LINE OF PARENT TRACT
  - = BLOCK NUMBER

1) COMMONWEALTH LAND TITLE INSURANCE COMPANY  
 2) RUDEN, MCLOSKEY, SMITH, SCHUSTER & RUSSELL, P.A.  
 3) TAMPA-HILLSBOROUGH COUNTY EXPRESSWAY AUTHORITY

NOT VALID WITHOUT THE SIGNATURE AND THE ORIGINAL RAISED SEAL OF A FLORIDA LICENSED SURVEYOR AND MAPPER.

DATE 9-26-02

BOB L. POTTER  
 PROFESSIONAL SURVEYOR AND MAPPER  
 FLORIDA CERTIFICATE NO. 3668  
 LICENSED BUSINESS FIRM

AIM ENGINEERING & SURVEYING, INC.  
 9400 LEE BLVD.  
 P.O. BOX 1229  
 LORLEIGH ACRES  
 FLORIDA 33576  
 800-222-1989  
 404-222-1989

REVISION BY DATE

NOT A SURVEY

TALPA-HILLSBOROUGH COUNTY  
 EXHIBIT 55 AT UT XORI TT

LEVEL DESCRIPTION AND SKETCH

STATE ROAD NO. 618 HILLSBOROUGH COUNTY

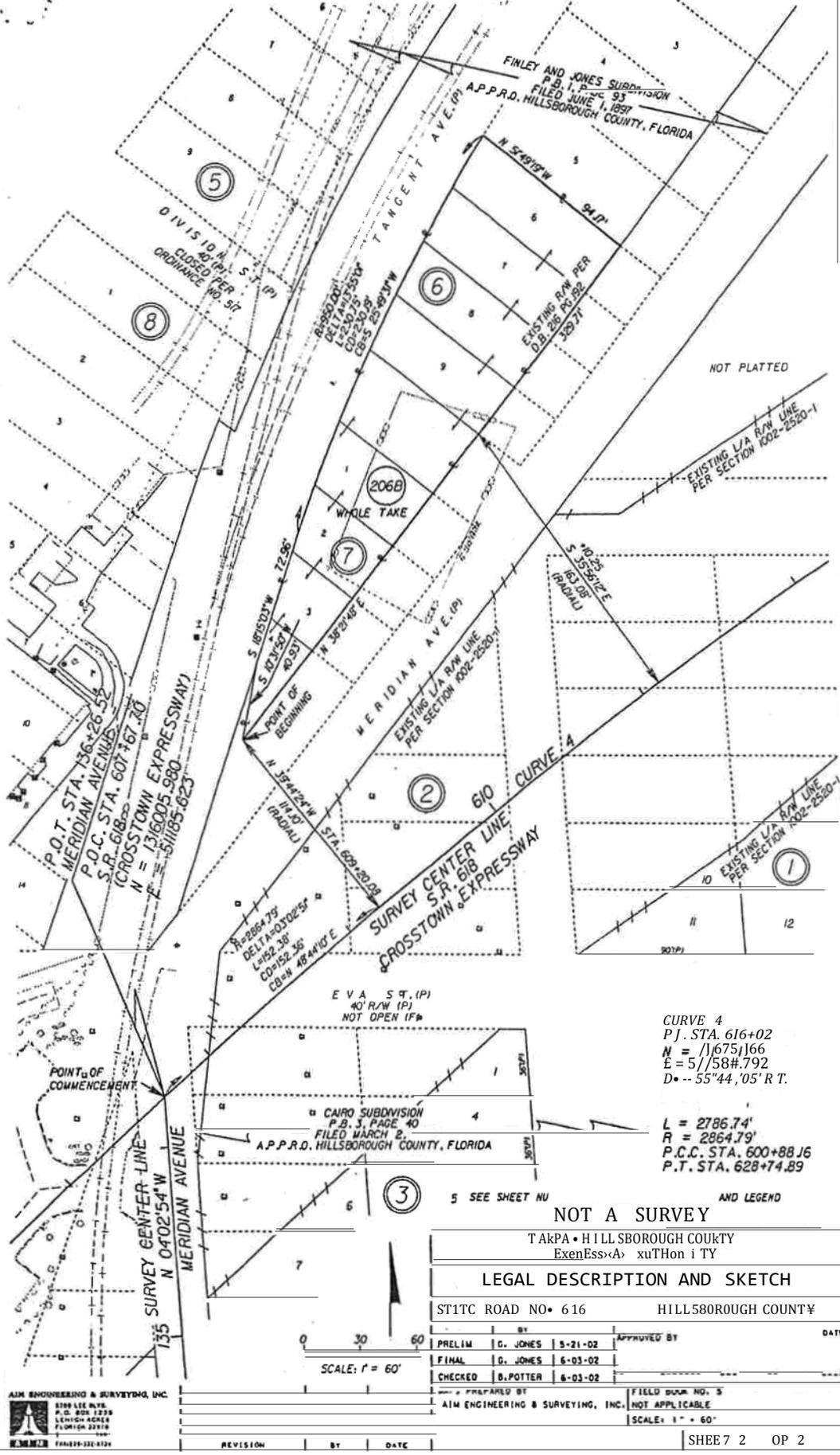
PRELIM [G. JONES] 07-01-04  
 FINAL [G. JONES] 06-03-02  
 CHECKED [B. POTTER] 06-03-02

MAPS PREPARED BY  
 AIM ENGINEERING & SURVEYING, INC.

FIELD BOOK NO.'S  
 NOT APPLICABLE  
 SCALE: N.T.S.

SHEET 1 OF 2

OR BK 12274 PG 1302



CURVE 4  
 P.J. STA. 616+02  
 N = 11675.166  
 E = 5158.792  
 D = 55°44'05" R.T.

L = 2786.74'  
 R = 2864.79'  
 P.C.C. STA. 600+88.16  
 P.T. STA. 628+74.89

5 SEE SHEET NU AND LEGEND

**NOT A SURVEY**

T AkPA • H ILL SBOROUGH COUITY  
 ExenEss•A• xuTHon i TY

**LEGAL DESCRIPTION AND SKETCH**

ST1TC ROAD NO• 616 HILL58OROUGH COUNT¥

BY	DATE	APPROVED BY	DATE
PRELIM G. JONES	5-21-02		
FINAL G. JONES	6-03-02		
CHECKED B. POTTER	6-03-02		

PREPARED BY: AIM ENGINEERING & SURVEYING, INC. FIELD BOOK NO. 5  
 NOT APPLICABLE  
 SCALE: 1" = 60'

REVISION	BY	DATE

SHEET 2 OP 2

AIM ENGINEERING & SURVEYING, INC.  
 3100 LEE BLVD.  
 P.O. BOX 1238  
 LEHIGH AVENUE  
 FLORENCE 29504





Exhibit "B"

TRAFFIC MANAGEMENT CENTER

Conference room is shared space by TMCLA & City. City to maintain.

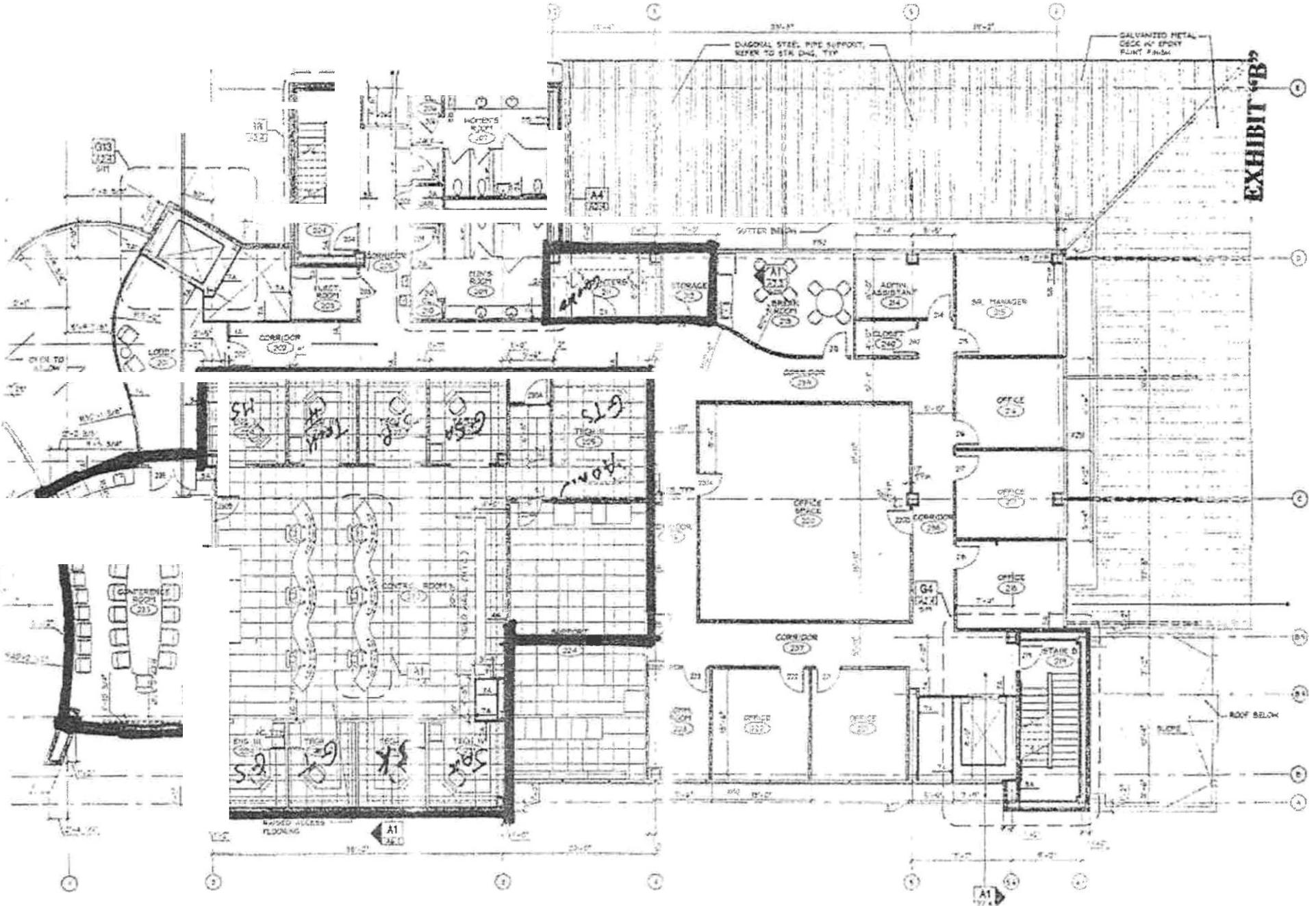


Exhibit "C"  
OPERATIONS MANUAL

Upon Recording, Return to:  
City of Tampa  
DPW/Transportation Manager  
306 East Jackson Street  
Tampa, FL 33602  
Tel: 813-274-8333

[Space Above This Line For Recording Data]\_\_\_\_\_

MEMORANDUM OF REVERSIBLE LANES OPERATING  
PROCEDURE & RESPONSIBILITIES

By and Between

THE CITY OF TAMPA, FLORIDA

and

THE TAMPA-HILLSBOROUGH COUNTY  
EXPRESSWAY AUTHORITY

This outline shall set forth the Reversible Lanes Operating Procedure and Responsibilities for the City of Tampa and the Tampa-Hillsborough County Expressway Authority. This outline is not intended to be all inclusive, it is understood that special events and emergency circumstances may arise that require coordination of additional services to operate the Crosstown Reversible Lanes Project. It is further understood and agreed that the terms and provisions herein may be amended and supplemented as necessary in the course of operating the system.

**Purpose & Scope:** The City of Tampa (TMC Operators) shall have primary responsibility to operate the Crosstown Reversible Lane Project (the Project) for the Tampa-Hillsborough County Expressway Authority (the Authority).

The responsibilities of the TMC Operators will be to staff the Reversible Lane consoles in the Traffic Management Center (TMC), monitor and engage the Reversible Lane software package and to perform a camera sweep of the facility before final gate opening/closing. A "camera sweep" will include verification of reversible lane device operations and that the facility is clear of conflicting traffic. TMC Operators will initiate the lane change/closure using the Reversible Lane console and will perform the camera sweep prior to each lane change/closure. A TMC Operator Supervisor shall oversee the operation and sign off on each event before road is opened. TMC Operators and the Authority shall operate the system under the following guidelines:

• Tampa, Florida •

## I. Reversible Lanes Operation

- 1) The Reversible lanes shall be opened for general public use Monday thru Friday each day starting at 5:30 AM and closed to general public use Monday thru Friday each day at 7:00 PM (Normal Operating Hours).
- 2) The Reversible lanes shall be available for use outside of Normal Operating Hours during special events subject to coordination of proper staffing by the City and the Authority.
- 3) The Reversible lanes shall be available for use outside of Normal Operating Hours for emergency events in such manner as may be required by law or special circumstances, in such event the City and Authority shall coordinate staff and supporting services in the best interest of the health, safety and welfare of the public.
- 4) Reversible Lanes from 7<sup>th</sup> St. east shall be changed from WB travel to EB travel at 9:30 AM each weekday.
- 5) Remaining WB travel lanes will be reversed to EB travel at 2:30 PM.**
- 6) Reversible lane system shall be closed to travel each workday at 7:00 PM.

## II. Reversible Lanes Maintenance Responsibilities

The City shall be responsible for monitoring Project facilities and initial recognition, documentation and reporting of deficiencies in Project facilities requiring minor or major repair or maintenance. The City has no direct maintenance responsibility for the Project facility beyond reporting issues discovered through routine system monitoring and operation. The City shall be responsible for routine maintenance of those TMC facilities in use by City staff.

The Authority shall be responsible for management and administration of routine and major maintenance of TMC facilities and Project facilities, including, but not limited to repair or replacement of Project monitoring equipment and software.

- 1) Response Contingency for system communications or monitoring systems shall be handled as follows:
  - 2) Should a communications failure occur between the TMC and a remote** Project device, then TMC operators will have to respond to a central field location to engage the system and perform one or more of the required Project changes.
  - 3) Should there be a total communications failure, then TMC Operators will be required to go to each individual Project device location (5 locations, multiple devices are controlled from each location) to engage devices for each appropriate Project event.

- 4) Should there be an individual device failure (gates will not work, sign has no power, camera needs replacement, etc.) then TMC Operators will investigate, perform routine troubleshooting and repair problem, if possible. Repairs beyond basic routine maintenance, the City shall notify the Authority of same as provided herein.**

### III. Vehicle Collision and Incident Management

In the event of a vehicle collision or incident on or affecting operation of the reversible lanes, the Project may need to be partially or completely closed to public use. Immediately upon the occurrence of a vehicle collision or incident on or affecting operation of the reversible lanes, TMC Operators shall notify appropriate emergency service responders and the Authority. TMC Operators shall have primary responsibility to assess and determine whether the vehicle collision or incident on or affecting operation of the reversible lanes merits partial or complete Project closure.

In the event of a vehicle collision or incident on or affecting operation of the reversible lanes, the City shall have primary responsibility to prepare any and all reports regarding the collision or incident and provide same to the Authority. The City shall be responsible to inspect the Project (by camera sweep or physical inspection, as necessary) after each collision or incident prior to returning the Project to full or partial operation. Any remedial measures or actions required to document, restore, clear debris or repair the Project for the purpose of returning it to full or partial operation shall be the responsibility of the Authority.

IV. Staffing for Reversible Lanes Project Management and Operations: the following represents minimum staffing levels required for the safe operation of the Project.

#### REQUIRED DUTIES

**Opening (1) requires 1 — Supervisor and 1 — Technician for 1 hour each.  
Change (2) requires 1 — Supervisor and 1 — Technician for 1 hour each.  
Change (3) requires 1 — Supervisor and 1 — Technician for 1 hour each.  
Closure (4) requires 1 — Supervisor and 1 — Technician for 1 hour each.**

Minimum staff time per day = 8 man hours

#### POSSIBLE ADDITIONAL DUTIES

- 1) Field operations would require a vehicle, supervisor and 1 technician for **1.0 hours.**
- 2) **Minimum staff requirements would be a vehicle and 1 technician for 1 hour.**
- \* ) **This will require a vehicle, supervisor and 1 technician for 1.5 hours.**
- 4) **Based on previous MOT experience, 1 technician for 2 hours will be needed per incident**

V. CONCLUSION

This is outline intended to be a manual and delineation of duties between the City and Authority in the administration and operation of the Project.

This memorandum has been prepared, reviewed and approved by the parties and shall be effective upon recording.

**ATTEST:**

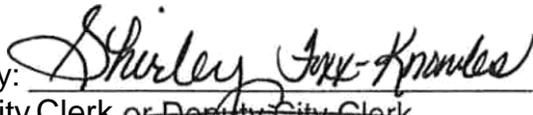
**Date: 1- 2 -05**

TAMPA-HILLSBOROUGH COUNTY  
EXPRESSWAY AUTHORITY

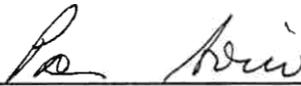
  
\_\_\_\_\_  
Ralph MERIWETHER, Executive Director

By:   
\_\_\_\_\_  
Name: J. Thomas Gibbs, Chairman

**ATTEST:**

By:   
\_\_\_\_\_  
City Clerk or Deputy City Clerk

**CITY OF TAMPA**

By:   
\_\_\_\_\_  
Pam Iorio, Mayor Date

Prepared pursuant to that certain  
Interlocal Agreement authorized by  
City of Tampa Resolution

  
\_\_\_\_\_  
J. Santia  
Assistant City Attorney

**HNTB Corporation**  
The HNTB Companies  
Infrastructure Solutions

201 N. Franklin Street  
Suite 1200  
Tampa, FL 33602

Telephone (813) 402-4150  
Facsimile (813) 402-4245  
www.hntb.com



The Honorable Anthony Foxx  
Secretary  
U.S. Department of Transportation  
1200 New Jersey Ave. SE  
Washington, DC 20590

**Subject: HNTB Corporation commitment to the Tampa Hillsborough  
Expressway Authority – Connected Vehicle Pilot**

August 1, 2016

Dear Secretary Foxx,

On behalf of HNTB Corporation, we are pleased to provide this letter of commitment to the Tampa-Hillsborough Expressway Authority (THEA) Connected Vehicle (CV) Pilot Deployment Program, Phases 2 and 3 submitted in response to the U.S. Department of Transportation's Notice of Funding Opportunity Number DTFH6116RA00007.

As THEA's General Engineering Consultant for over 15 years, and the Program Management Lead for phase 1 of their CV Pilot, HNTB is proud to be continuing in the Program Management Lead role and commits the resources to make this exciting deployment of emerging technology a rousing success.

Best regards,

A handwritten signature in black ink, appearing to read "Steve Johnson".

Steve Johnson, CVP  
Senior Program Manager  
HNTB Corporation



August 1, 2016

The Honorable Anthony Foxx  
Secretary  
U.S. Department of Transportation  
1200 New Jersey Ave. SE  
Washington, DC 20590

**Subject: Siemens commitment to the Tampa Hillsborough Expressway Authority  
Connected Vehicle Pilot Deployment Program (Phases 2 and 3)**

Dear Secretary Foxx,

On behalf of Siemens, we are pleased to provide this letter of commitment to the Tampa-Hillsborough Expressway Authority (THEA) Connected Vehicle (CV) Pilot Deployment Program Phases 2 and 3 submitted in response to the U.S. Department of Transportation's Notice of Funding Opportunity Number DTFH6116RA00007.

Having worked closely with the City of Tampa through the US Department of Transportation/Tampa Hillsborough County Expressway Authority (THEA) Connected Vehicle (CV) Pilot Deployment Phase I, we see firsthand how the city is setting the national stage for a real-world environment that will allow vehicles, roadside infrastructure, and mobile devices to communicate with each other. This effort already underway is offering THEA unprecedented opportunities to provide improved safety and mobility solutions enabled by connectivity. Through Phase 2 and 3 we believe this will spur innovation among early adopters of connected vehicle application concepts and operationalize and measure the impacts for adoption of CV technologies to be shared at a national level.

THEA is well positioned to utilize ITS technology to improve transportation within its city and region, and deliver results in its CV Pilot Phase 2 and 3. We believe THEA's innovative applications will pave the way for many cities to adopt these solutions. We look forward to partnering with THEA in the execution phases of this proposal, once awarded.

Sincerely,

---

Marcus Welz  
Chief Executive Officer  
Siemens ITS

---

Rajarshi Ghosh  
Chief Financial Officer  
Siemens ITS



**August 1, 2016**

**U.S. Department of Transportation  
Office of the Assistant Secretary for Research and Technology  
ITS Joint Program Office**

**RE: Letter of Support — NoFO DTFH611RA0007 — Connected Vehicle Pilot Deployment Program**

**Dear Sir or Madam:**

**Please consider this letter as an expression of support by the Center for Urban Transportation Research at the University of South Florida (CUTR) as a partner with the Tampa Hillsborough Expressway Authority (THEA) for advancing the deployment of connected vehicles and connected vehicle technologies through the US DOT Connected Vehicle Pilot Deployment Program. CUTR formally entered into a partnership with THEA to explore and evaluate connected and automated vehicles in July 2013 and has continually supported the Authority in this area.**

**Most recently, CUTR was an active partner in developing the concept for a Tampa connected vehicle pilot deployment and provided support to THEA for Phase I of the Pilot Deployment Program, mainly in the areas of performance measurement and proposed experimental design. CUTR is poised to take an active role supporting THEA in Phases II and III of the Connected Vehicle Pilot Deployment Program and will commit all resources required to complete the activities that THEA assigns to CUTR. At a minimum, three senior-level researchers have programed the majority of their time to providing this support for the duration of the next phases of the project. If THEA awards CUTR a contract to participate in Phases II and III, CUTR will dedicate the additional resources that are commensurate with the level of involvement in the project.**

**We hope that US DOT continues to support this effort through the funding of the next phases for final design, deployment, and evaluation. We look forward to supporting THEA and its partners.**

**sincerely,**

A handwritten signature in black ink, appearing to read "Dennis Hinebaugh", is written over a horizontal line.

**Dennis Hinebaugh, interim Director  
Center for Urban Transportation Research, USF**

**cc: Mr. Joseph Waggoner, THEA Executive Director**

## THEA CV Pilot Phase 2&3 Letter of Commitment from Global-5

---

August 1, 2016

**Mr . Bob Frey**  
**Planning Director**  
**Tampa Hillsborough Expressway Authority**  
**1104 East Twiggs Street, Suite 300**  
**Tampa, FL 33602**

**Dear Mr. Frey,**

**Please accept this letter as Global-5's commitment to perform our roles to manage Outreach, including development and maintenance of the pilot website, conference and trade show attendance, media relations, community relations and other Outreach activities as detailed in the Task 11 Outreach Plan. Global-5 is also committed to managing Task 9 activities including the recruitment of pilot participants, training for pilot participants, and retention of pilot participants during Phases 2 and 3 of the THEA CV Pilot. Global-5 will be coordinating all Outreach and Recruitment activities to provide the greatest cost efficiency and effectiveness.**

**Global-5 will continue to work with THEA managers and additional Pilot Task Leaders to coordinate all efforts to provide an exceptional CV Pilot implementation.**

**Thank you for this opportunity.**

**Sincerely,**



**Mary Hamill**  
**President & CEO**  
**Global-S Communications**

July 31, 2016

The Honorable Anthony Foxx  
Secretary  
U.S. Department of Transportation  
1200 New Jersey Ave. SE  
Washington, DC 20590

Re: Tampa CV Pilot Project

Dear Secretary Foxx,

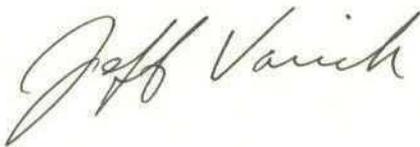
It is my pleasure to issue this Letter of Commitment on behalf of Brandmotion, LLC, and confirm our support of the Tampa CV Pilot project. As a company involved in and committed to advancing the safety of every car already on the road, Brandmotion is extremely honored to be serving the city of Tampa, and the USDOT, in furthering our country's efforts to improve the safety of US roads.

The mission of our company – “Safer Cars Faster” – aligns 100% with the mission of the CV Pilot project, and as such, the Tampa project has our 100% support and commitment. All of the employees of Brandmotion are honored to be a part of it, and each one of us sees our contribution as tangible, real, and vital to the success of the Pilot project.

We have a very clear role. Brandmotion's responsibility is to own and manage the process of selecting and integrating the underlying V2X technology for each of the 1520 vehicles that are planned to be outfitted for the Pilot. We will source the appropriate technology, we will design and source a cost-effective information display for the driver of each vehicle, we will oversee the installation of technology into every vehicle, and we will support the vehicles during the Pilot.

Again, we are proud to have been selected to be part of the Pilot, and we look forward to working hard to be a part of the Pilot's eventual success.

Sincerely,



Jeff Varick  
President and Founder



**August 1, 2016**

**U.S. Department of Transportation  
Office of the Assistant Secretary for Research and Technology  
ITS Joint Program Office**

**RE: Letter of Support — NoFO DTFH611RA0007 — Connected Vehicle Pilot Deployment Program**

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**sincerely,**

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**Dennis Hinebaugh, interim Director  
Center for Urban Transportation Research, USF**

**cc: Mr. Joseph Waggoner, THEA Executive Director**

U.S. Department of Transportation  
ITS Joint Program Office-HOIT  
1200 New Jersey Avenue, SE  
Washington, DC 20590

Toll-Free "Help Line" 866-367-7487  
[www.its.dot.gov](http://www.its.dot.gov)

FHWA-JPO-16-322



U.S. Department of Transportation